FLIGHT

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport.

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NOTICE.—Next week's issue of "FLIGHT" (December 14th) will contain a Christmas Greeting Section in Two Colours. Orders should be placed early to ensure obtaining copies.

EDITORIAL COMMENT.

The Changes at the Admiralty.

WITH the advent of Sir John Jellicoe to the Admiralty as First Sea Lord, it is permissible to hope that there may be a change for the better in Admiralty policy in regard to the Air Service. It is true that the constitution of the Board lays down that the duty of the First Sea Lord is: "In all matters of strategy: to advise," and that, therefore, he has directly very little to do with the administrative functions of the Air Department. But the all-round efficiency of every department has so great a bearing on the strategy of war, that it is very much the concern of the First Sea Lord to know that everything which makes for that efficiency is in smooth working order and to insist upon change in any or all directions in which there is friction.

After nearly 2½ years in command of the Grand Fleet, Sir John Jellicoe is in the position of knowing exactly what is wanted to maintain our naval supremacy, and that he will insist upon all the essentials being forthcoming we need not doubt for an instant. So far as concerns the Air Service, it is doubly fortunate that Sir John has been appointed. Not only does he know at first hand the exact bearing on sea power of air policy as a result of his work afloat, but he returns to the Admiralty also fortified by administrative experience of the Air Department itself. Prior to the war, and when Sir John was Second Sea Lord, it was he who was responsible to the Board for the development of the Air Service, and it was under his advice that it grew from nucleus form to the comparatively established service it had become at the outbreak of war. He will thus be in an excellent position to judge of the controversies which have led to the present state of deadlock which exists between the Admiralty and the Air Board, and we doubt not his ripe experience and his knowledge of the necessities of the situation will be brought to bear on this as well as on other problems of Naval administration which are crying aloud for settlement.

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The Cabinet Crisis and the Air.

In the ordinary course of events the question of relations between the Air Board and the fighting services was to have been debated in the House of Commons on Tuesday this week. We had fully expected that the most important conclusions would have been arrived at as a consequence of a thorough discussion of the differences and that a very long step would have been taken towards their composition. In the light of the long over-due Cabinet crisis which came to a head during the week-end and the re-shuffling of the cards which will inevitably result from it, there has been inevitably a further postponement of the looked-for debate. Indeed, circumstances may well arise to render public discussion unnecessary.

Writing as we are compelled to do early in the week, it is a matter of considerable difficulty to arrive at any fixed conclusion as to the exact turn events are likely to take. The facts as we know them at

present are that the War Council is to be strengthened by the scrapping of some of the less virile of its members and by the inclusion of others who will, we trust, bring to bear a wider outlook and more of the spirit of forcefulness than has been manifested by the old Council. Had that spirit been more marked, the necessity for the public discussion of our weaknesses would in all probability never have arisen. What the nation needed was a War Council which could make up its collective mind to act, and that is what we have not had. Let us take this matter of the Admiralty-Air Board controversy as a case in point. We have on the one side a Board which takes the point of view that a certain course is the only one to be adopted if we are to make the most of our resources for the business of winning the war. On the other, we have one of the fighting Services which differs from the Board on the fundamentals of how those resources can be used to the best advantage. Both Admiralty and Air Board are sincere in the point of view—it would be absolutely and entirely out of the question to argue otherwise. Therefore, we are reduced to this: that there is a conflict of opinion in which one side or the other is right, and until that conflict has been adjusted the nation cannot be satisfied that everybody is doing his best to shorten and to win the war.

Now, we have a War Council whose business it is —or ought to be—to compose such differences. It has the power, under the Cabinet, to say to one or other of the parties to the dispute: "You are to do this or that," and that party must either carry out its orders or give place to someone else who will. But that is exactly where the War Council as it is at present constituted—or was at the beginning of the week—has failed. It has allowed this and other matters to drag on week after week and month after month, what time the enemy is straining every nerve and every resource to pass us in preparations for next year's campaigns. It has proved itself a body as spineless as a jellyfish. It has worked on the principle of never doing to-day what can be put off until the morrow. In the middle of the greatest war of all time it has consistenly and invariably failed to do anything until it has been kicked into action by sheer force of public opinion. It has failed utterly to realise that the nation expects to be led and not followed, and that what the country demands is a body which will "Act," and not a mere debating society which does nothing but adjourn its discussions.

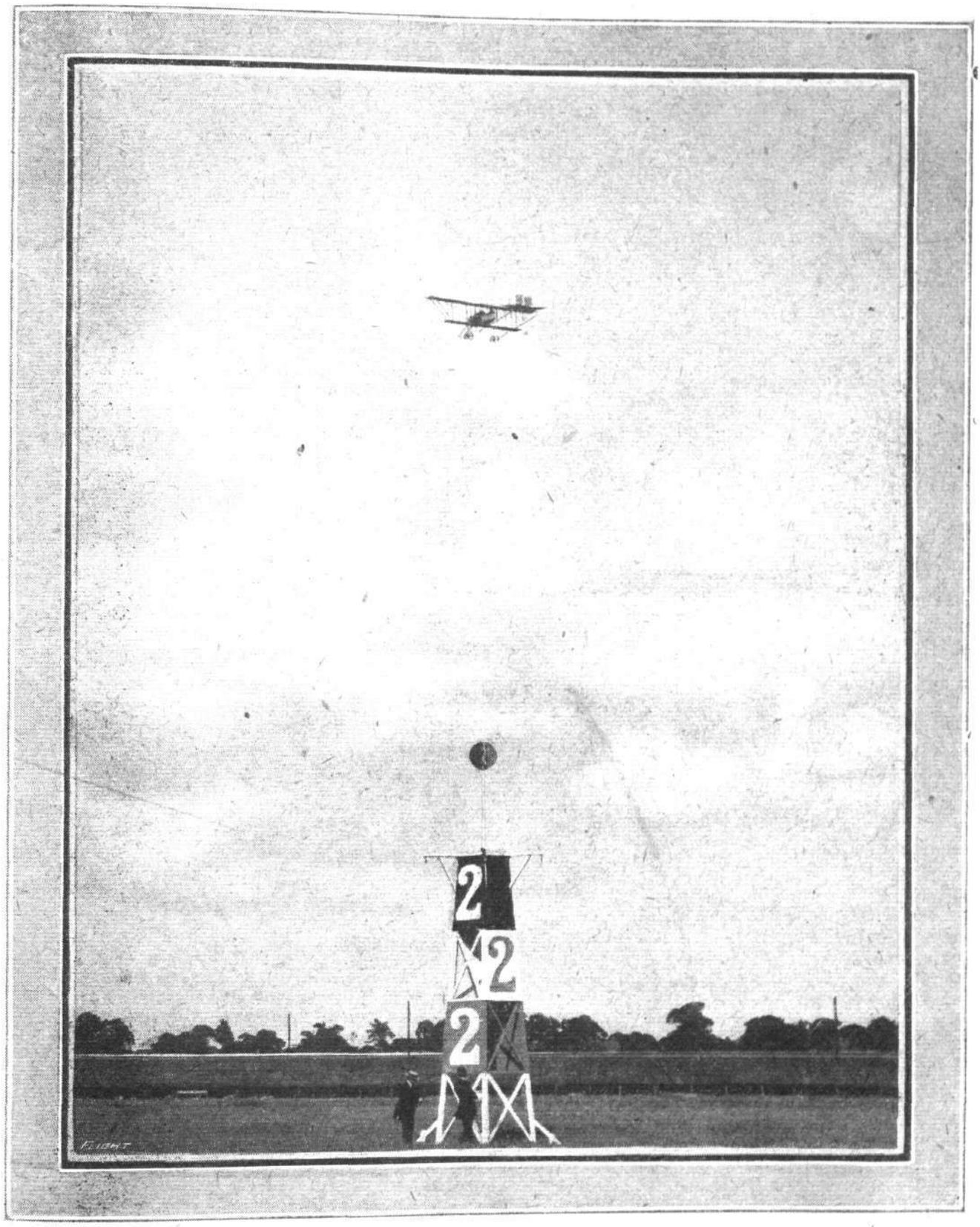
We are entirely against Cabinet-making by the newspaper Press at a time like this. The agitation which has for its text that somebody "Must Go" savours too much of the old Party game to be accepted by the plain, thinking citizen who has no concern but that of getting on with the business of the war. Wrecking for wrecking's sake is the worst of all possible remedies, because of its reactions on all parties. If we are to have our Cabinets made in Fleet Street, and if Governments and individuals are to fall at the caprice of editors, then good-bye to all our hopes of victory. We are all for keeping the Government of the day up to the mark, as we are all for ruthlessly scrapping those who have for any reason at all failed the country in its hour of need. But there is a difference. There are some members of the present Government who most certainly do not possess the confidence of the country, yet they are being kept in their several offices because—well, it passes our comprehension to know why. There are others in whom the country has unbounded confidence. That being so, we are in full accord with those who are clamouring for the dismissal of the one lot and the retention of the others, but we do think that the Press agitation has gone too far in certain quarters. It is no part of the duty of the Press to impose its own policy on a Government which is manifestly in a better position to judge of policy than its critics. So far as we are able to discern, it is not that the *policy* of the Government is wrong, but that that policy is not pursued with the requisite strength and determination. Again, let us revert to the matter of the Air Board for an illustration of this. The policy that dictated the formation of the Board was altogether admirable. At the time it was formed we believed that it was really to be armed with the powers necessary to put our Air Services on the best possible footing. Performance was weak, despite the fact that policy was sound. The result was the fiasco we have seen. By all means, then, let us get rid of the bureaucrats who are so jealous of departmental "rights" that they apparently put them before even victory, but let us be careful that we do not exchange the rule of King Log for that of King Stork.

If the result of the present crisis is to give us a real War Council with sufficient moral backbone to decide things as they arise and to enforce its decisions—and such a War Council can be formed without much difficulty—it may well be that we shall be saved the unedifying spectacle of the Parliament of the greatestEmpire on earth discussing the question of whether the Admiralty or the Air Board is the real friend. We have advocated this discussion, because we felt that unless it took place nothing would be done. The necessity for such a deplorable exhibition of weakness we have deprecated. Now we have hope that it will not be necessary after all. If out of the crisis emerges a War Council which inspires the nation with confidence, and if the assurance is forthcoming that one of the first things with which that Council will concern itself is the matter of our aerial supremacy, then we are quite content to leave the question to the Council in the meantime. But in return for its confidence the nation will ask for ACTION, prompt and far-reaching.

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"Prepare for 1917."

Once again we are impelled to return to the subject of the supreme importance of preparing for the efforts the enemy is sure to make next Spring to wrest from us the mastery of the air on the Western front. We have said "next Spring," but we ought really to write in the present tense, and say that we must strain every nerve to meet the efforts the Germans are putting forth even now. For example, in the *Times* the other day was published, as if in corroboration of our comments last week, an extract from a letter written by an officer at the front, in which the writer says: "I saw a pretty good air



REMINISCENCES OF HENDON.—René Desoutter on a Caudron.

fight the other day, and Fritz had us beat to the wide. His machines were twice as fast as ours."

We are neither alarmist nor pessimist, but we have been hearing too much of the same sort of thing lately. It is in the nature of things that in a war of the magnitude of the present struggle there will occur numberless cases in which one side or the other is in possession of a local superiority in men or materials. That being so, it must sometimes be the case that the obsolescent British machine will find itself up against a more modern and therefore more efficient enemy aeroplane, and conversely. But when that sort of thing occurs with something approaching regularity it becomes disquieting, and we are led to ask if all is as well as we are asked to believe, and whether we are in fact doing all that the situation demands? In particular are we concentrating enough on the provision of squadrons of fast scouts, machines that will beat the latest German types—or at least equal them—in speed and climbing capacity? It is absolutely vital to the success of our aerial operations that such machines shall be provided, and that without delay, as an answer to the Roland and Halberstadt machines that the enemy is now putting into the air on the Somme front, and of whose wonderful speed and climbing powers we hear a great deal. They must be answered in kind—we have the means—and to make the answer effective entails that we shall have to concentrate our energies on the output of engines—big engines of a power and type that will put the speed and climbing capacity necessary to meet offensive with offensive into the hands of our airmen at the front. We have the best airmen in the world—airmen who to maintain our mastery of the air will go up and take chances in meeting the superior German machines, but we ask: Is it right that our pilots should be asked to take these chances? The question does not require answering. It most certainly is not right that we should depend for our supremacy on the superior skill and the greater daring of our personnel. That we are able to maintain it is a wonderful tribute to the gallantry and self-sacrifice of the R.F.C., especially when we are cognisant of the handicap imposed upon them by the large numbers of obsolescent machines that are in use at the front. We know that it is impossible that these can be replaced in the twinkling of an eye. Further, we know that efforts are in fact being made to keep our material in front of that of the enemy, but we are by no means satisfied that *everything possible* is being done in that direction. That is in great part due to the existing unsatisfactory state of affairs as regards the Air Board, a matter that we have dealt with elsewhere. We have indicated the remedy—more and yet more squadrons of fast, powerful scouts. That is what we have to go for, or we shall stand in grave danger of losing that complete mastery of the air which we hold at present. Indeed, we would put the matter in a stronger light, and say that we are even now in danger of weakening in our hold, and that only by the most whole-hearted effort on our part can we maintain our full hold. We can build the machines; the crux is engines. That seems to be the critical point on which our efforts must be still further concentrated.

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The Raid on London.

There was nothing surprising in last week's aeroplane raid on London, except that it came so late in the war. It was only what was to be expected and what was very long overdue. Why no enterprising enemy airman had not taken his fortune in his hands many months ago we do not profess to understand. Fortunately, the experience of last week's raider is not one to encourage the others, else we should have committed ourselves to the prophecy that as this was the first, so it would not be the last. As it happened no particular damage was done, and the raider was intercepted and brought down before he could reach the friendly shelter of his base. Such an experience will probably give the Germans to ponder, although at the same time it would be the rankest folly on our part to assume that for the future we are likely to be immune from such spasmodic raids. On the contrary, they are very likely to recur—and not with single machines—from time to time, and it is for us to consider the best means of guarding against them.

To our way of thinking, the best defence against these raids lies in carrying the war into the enemy's country. Let the Germans be given to understand that every such raid will be countered by two raids on open enemy towns for every one carried out on this country. We held aloof from the policy of reprisal as long as it was possible to do so, but we are now convinced that it is the only possible one to employ against such an enemy as we are engaged with now. It is the only argument he can understand, and the sooner we revert to the Mosaic code of an eye for an eye and a tooth for a tooth, the sooner will the German mind grasp the fact that "frightfulness" is a two-edged tool that is apt to cut the one who employs it. As long as we refrain from reprisals, the enemy will continue to believe—as he undoubtedly does—that we have not the means at our disposal to hit him where he lives, or that if we have the means we are afraid to employ it. Let us show him that neither of these theories is correct, and these raids will cease at once. Refrain, and we shall never be safe from them.

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Honours for Zepp. Strafers.

THE following was announced by the Secretary of the Admiralty on December 3rd:—

"The King has been pleased to approve the award of the Distinguished Service Order to Flight Sub-Lieutenant EDWARD L. PULLING, R.N.A.S., and of the Distinguished Service Cross to Flight Lieutenant EGBERT CADBURY and Flight Sub-Lieutenant GERRARD W. R. FANE, of the R.N.A.S., in recognition of their distinguished services on the occasion of the destruction of a Zeppelin airship off the Norfolk coast, in early morning of Tuesday, Nov. 28th, 1916."

In the *London Gazette* of December 6th the award of the D.S.O. to Flight Sub-Lieut. Pulling is given as follows:—

"In recognition of the skill and gallantry which he displayed on the morning of the 28th of November, 1916, in pursuing out to sea, attacking at close range, and destroying a Zeppelin, which had been engaged in a raid on England. Flight Sub-Lieutenant Pulling was exposed to machine-gun fire throughout the attack."

The awards of the D.S.C. to Flight Lieut. Cadbury and Flight Sub-Lieut. Fane are referred to in the same way, except for the omission of the words "and destroying a Zeppelin."

FLIGHT

The British Air Services

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, *it is not repeated in this column.*

Royal Naval Air Service.

Admiralty, November 28th.

Lieut.-Comdr. J. I Harrison graded as Flight-Comdr., late Nov. 16th.

Temp. Lieut. (R.N.V.R.) G. W. F. Fraser granted acting rank of Lieut.-Comdr., R.N.V.R., to date Nov. 20th.

The following entered as Prob. Flight Officers for temp. service, and appointed to "President," additional for R.N.A.S., date as stated: N. R. Harben, C. T. Greenwood, F. A. Frost, V. H. Clift, J. F. R. Kitchin, H. L. P. Lester, J. C. Grant, E. H. S. Low, C. Lowther, W. E. B. Oakley, Chief Petty Officer E. J. Addis, Acting Petty Officer L. W. E. Leage, Dec. 3rd; H. C. M. Fitton, Nov. 6th; G. B. G. Scott, C. G. Brock, E. C. R. Stoneman and A. G. A. Spence, Oct. 28th.

Temp. Engr. Sub-Lieut., R.N.R., G. Towers entered as Prob. Flight Officer for temp. service and appointed to "President," additional for R.N.A.S., to date Nov. 25th; temp. commission as Engr. Sub-Lieut., R.N.R., terminated.

E. Gough entered as Temp. Warrant Officer, second grade, and appointed to "President," additional, for R.N.A.S., date Nov. 27th.

Admiralty, November 29th.

Acting Air-Mec., 1st grade, R. A. Tanner and A. A. Allan granted temp. commissions as Lieuts. R.N.V.R., and appointed to "President," additional for R.N.A.S., date Nov. 27th and Nov. 28th respectively.

C. N. Ellen granted temp. commission as Sub-Lieut., R.N.V.R., and appointed to "President," additional for R.N.A.S., date Nov. 27th.

Temp. Engr. Sub-Lieut. R.N.R., C. W. Halfhide entered as Prob. Flight Officer, for temp. service, date Nov. 28th.

Admiralty, November 30th.

The undermentioned entered as Prob. Flight Officers for temp. service, to date as stated: H. le Roy Wallace, Oct. 9th; H. E. Grundy, Nov. 9th; and J. P. Hales, Oct. 12th.

Admiralty, December 1st.

Lieut. L. G. G. Groves, to "President," for service in R.N.A.S., temp., date Nov. 30th.

A. H. Loft entered as Temp. Prob. Flight Officer for temp. service, and appointed to "President," additional, for R.N.A.S., date Nov. 22nd.

Admiralty, December 4th.

A. Williams, E. C. St. John, and C. L. D. Willcox granted temp. commissions as Lieut., R.N.V.R., and appointed to the "President," additional, for R.N.A.S., to date, Dec. 2nd.

Temp. Sub-Lieut., R.N.V.R., H. S. Keightley appointed to the "President," additional, for duty with R.N.A.S., to date, Dec. 2nd.

Royal Flying Corps (Military Wing).

London Gazette, November 28th.

Flying Officers (Observers).—2nd Lieut. E. B. B. Jefferson, L'pool. R., and to be secd.; Aug. 10th. Nov. 12th: 2nd Lieut. (Temp. Capt.) H. G. Rickards, Lond. (Howitzer) Brig., R.F.A., T.F.; Temp. 2nd Lieut. A. N. Nesbitt, R. Innis. Fus., and to be transfd. to Gen. List.

Equipment Officer, 1st Class.—Temp. Lieut. E. G. Toye, Gen. List, from the 3rd Cl., and to be Temp. Capt. whilst so emplyd.; Nov. 20th.

Equipment Officers, 2nd Class; from the 3rd Class:—Nov. 1st: Temp. Lieut. E. J. Howard, Gen. List; Qmr. and Hon. Lieut. L. Newman, City of Lond. Yeo., T.F. And to be Temp. Lieuts. whilst so emplyd.: 2nd Lieut. R. K. C. Maguire, S.R.; 2nd Lieut. K. D. Abercromby, S.R.; Temp. 2nd Lieut. J. W. Burt, Gen. List; Temp. 2nd Lieut. J. R. Grant, Gen. List; Temp. 2nd Lieut. S. E. Devonald, Gen. List; Temp. 2nd Lieut. J. H. Banks, Gen. List; 2nd Lieut. E. Stokes, S.R.; 2nd Lieut. W. M. Cumming, S.R.; 2nd Lieut. J. L. Luntley, S.R.; 2nd Lieut. L. Auker, Gen. List. 2nd Lieut. B. J. Nicholson, S.R.; Nov. 13th.

Memoranda.—Capt. the Hon. E. A. Stonor, R.F.C., S.R., to be Temp. Major (without the pay and allowances of that rank while specially employed; Nov. 25th. Temp. Lieut. G. Graham, Gen. List, a flying officer (Observer) takes rank and precedence in the R.F.C. and in the Army as if his appointment as Temp. Lieut. bore date Oct. 9th. The Hon. E. St. G. Caulfield, late R.F.C., S.R., to be Temp. Lieut. while employed as a recruiting officer; Nov. 7th.

London Gazette Supplement, November 29th.

Flight Commanders.—Temp. Lieut. H. D. Jensen, Gen. List, from a Balloon Officer, and to be Temp. Capt. whilst so emplyd.; Oct. 24th. Nov. 10th: Capt. F. C. Baker, D. of Corn. L.I., S.R., from a flying officer and to remain secd. From Flying Officers and to be Temp. Capts. whilst so emplyd.: 2nd Lieut. R. Gregory, Conn. Rang., S.R.; Lieut. P. C. Campbell, Arg. and Suthd. Highrs., S.R., Nov. 17th.

Flying Officers.—2nd Lieut. K. I. Mackenzie, Arg. and Suthd. Highrs., and to be secd.; July 17th. Nov. 1st; Temp. Capt. J. M. Heap, A.S.C., and to be transfd. to Gen. List; Temp. 2nd Lieut. R. N. G. Atkinson, Middx. R., and to be transfd. to Gen. List. Nov. 2nd: Capt. L. S. Platt, 17th Lrs.; 2nd Lieut. I. M. Davies, Welsh R., and to be secd. Nov. 6th: 2nd Lieut. R. A. Grosvenor, 2nd D. Gds., S.R.; Temp. 2nd Lieut. R. D. C. Blake, 10th Res., Regt. of of Cav., and to be transfd to Gen. List; Temp. 2nd Lieut. (on prob.) J. H. Cooper, Gen. List; 2nd Lieut. W. B. Melville, S.R.; Temp. 2nd Lieut. (on prob.) E. D. Howard, Gen. List. Nov. 7th: Temp. 2nd Lieut. F. G. Litchfield, Gen. List; Temp. Lieut. H. Norton, R. Lanc. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. B. C. Rice, Gen. List, from a flying officer (Observer), with seniority from Nov. 22nd, 1915; Temp. 2nd Lieut. F. H. Reynell, Gen. List; 2nd Lieut. (on prob.) F. C. Craig, S.R. Nov. 8th: Temp. Lieut. G. E. Giles, Gen. List, from an Equipment Officer, 3rd Class; Temp. 2nd Lieut. (on prob.) C. F. Crapp, Gen. List; Temp. 2nd Lieut. (on prob.) J. H. Gotch, Gen. List; Temp. 2nd Lieut. (on prob.) E. O. L. Bell, Gen. List; Lieut. (Temp. Capt.) F. P. Don, Sco. Horse Yeo., T.F., from a Flying Officer (Observer), with seniority from June 16th. Nov. 9th: Lieut. A. T. Adams, Wilts. R., S.R.; Temp. 2nd Lieut. G. W. Shuter, Gen. List; Lieut. J. G. S. C. Smith-Grant, R. Scots, T.F.; 2nd Lieut. C. F. Smith, L'pool. R., T.F.; 2nd Lieut. F. P. Williams, S.R.; 2nd Lieut. F. H. Holdsworth, S.R. 2nd Lieut. G. A. Masters, London R., T.F.; Nov. 11th. Temp. 2nd Lieut. A. J. Pearson, M.C., Machine Gun Corps, and to be transfd. to Gen. List; Nov. 13th.

Balloon Officer.—2nd Lieut. (on prob.) E. L. Pape, S.R., Aug. 17th.

Equipment Officers, 1st Class.—Capt. E. R. L. Corballis, R. Dub. Fus., from a Flight Comdr.; Oct. 16th.

2nd Class.—From the 3rd Cl., and to be Temp. Lieuts. whilst so employed:—Nov. 1st: 2nd Lieut. C. R. Fry, S.R.; 2nd Lieut. E. G. A. Lefrere, S.R. 2nd Lieut. N. Turner, S.R.; Nov. 13th.

3rd Class.—Temp. 2nd Lieut. J. H. Thorpe, Gen. List; Oct. 1st. Nov. 7th: 2nd Lieut. (Temp. Lieut.) W. Redmond, Lan. Fus. (T.F.); Temp. 2nd Lieut. (on prob.) L. S. R. Poole, Gen. List; Temp. 2nd Lieut. (on prob.) C. Rawdon-Schofield, Gen. List; Temp. 2nd Lieut. F. W. Poat, Gen. List; Temp. 2nd Lieut. (on prob.) D. G. Robinson, Gen. List; 2nd Lieut. (on prob.) W. L. Shaw, S.R.; 2nd Lieut. (on prob.) G. J. C. Gunn, Sco. Rif., S.R., and to be secd.; 2nd Lieut. (on prob.) H. Hoad, S.R.; 2nd Lieut. (on prob.) A. Graham, S.R.; 2nd Lieut. (on prob.) H. J. G. Dyer, S.R.; Temp. 2nd Lieut. H. Haddon, Gen. List; Temp. 2nd Lieut. (on prob.) J. P. Burden, Gen. List; Temp. 2nd Lieut. T. Allen, Gen. List; Temp. 2nd Lieut. (on prob.) T. F. Braines, Gen. List; Temp. 2nd Lieut. D. Armitage, Gen. List; Temp. 2nd Lieut. R. W. Atchley, Gen. List; 2nd Lieut. L. Davies, S.R.; Temp. 2nd Lieut. H. Cooke-Smith, Gen. List; 2nd Lieut. (on prob.) T. Cooper, S.R.; Temp. 2nd Lieut. S. F. Barton, Gen. List; Temp. 2nd Lieut. R. L. Cobb, Gen. List; Temp. 2nd Lieut. J. C. Courtice, Gen. List; 2nd Lieut. E. P. Lyon, S.R.; 2nd Lieut. M. J. James, S.R.; Temp. 2nd Lieut.

J. W. Jennings, Gen. List; Temp. 2nd Lieut. N. H. Knock, Gen. List; 2nd Lieut. G. W. Longstaff, S.R.; Temp. 2nd Lieut. D. M. Mackie, Gen. List; Capt. L. H. Tosswill, Worc. R., S.R., and to be secd.; Temp. 2nd Lieut. S. N. Veitch, Durh. L.I., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) L. Wigley, Gen. List; Temp. 2nd Lieut. (on prob.) C. E. Tebbs, Gen. List; Temp. 2nd Lieut. (on prob.) F. Ward, Gen. List; Temp. 2nd Lieut. (on prob.) L. G. Stevenson, Gen. List; 2nd Lieut. (on prob.) W. H. R. Skudder, S.R.; Temp. 2nd Lieut. (on prob.) K. A. Smith, Gen. List; Temp. 2nd Lieut. (on prob.) L. L. W. Smythe, Gen. List; Temp. 2nd Lieut. (on prob.) H. Stansfield, Gen. List; 2nd Lieut. (on prob.) J. F. B. Smith, S.R.

Memorandum.—1st Cl. Air-Mech. G. M. Turnbull, from R.F.C. to be Temp. 2nd Lieut., for duty with the Military Wing of that Corps; Aug. 10th.

Supplementary to Regular Corps.—2nd Lieut. J. G. Hutt resigns his commission; Nov. 30th. The notification in the *Gazette* of Aug. 22nd of the appointment of 2nd Lieut. (on prob.) G. M. Turnbull is cancelled. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: W. B. Melville, F. P. Williams, F. H. Holdsworth, L. Davies, M. J. James, H. Stroud, L. W. White. The under-mentioned to be 2nd Lieuts. (on prob.): W. E. Nuttall; Oct. 23rd. N. Martin; Nov. 5th. A. G. Griggs; Nov. 6th. J. G. Hope; Nov. 14th.

London Gazette, December 1st.

Temporary Appointments at War Office.

Staff Lieutenant.—Capt. G. W. Williamson, M.C., Manch. R., S.R., from a Flying Officer, and to remain secd., vice Capt. E. S. Skipper, R.F.C., S.R.; Nov. 11th.

Flying Officers.—2nd Lieut. L. W. White, S.R.; Nov. 5th. Nov. 8th: Temp. Lieut. W. E. Sandys, A.S.C., and to be transfd. to Gen. List; Temp. Lieut. W. H. Segrave, A.S.C., and to be transfd. to Gen. List; 2nd Lieut. A. G. D. Alderson, Worc. R., S.R., and to be secd.; 2nd Lieut. F. K. Laverton, Glouc. R., S.R., and to be secd.; Lieut. J. Whittaker, E. Lanc. R. (T.F.); Temp. 2nd Lieut. N. C. McClelland, Gen. List. Nov. 9th.: Temp. 2nd Lieut. H. M. Over, R. Fus., and to be transfd. to Gen. List; 2nd Lieut. G. Vaughan-Jones, E. Anglian Divl. Sig. Co., R.E. (T.F.); 2nd Lieut. E. T. Curling, Lond. R. (T.F.); 2nd Lieut. (Temp. Lieut.) P. J. G. Powell, A.S.C., and to be secd.; Temp. 2nd Lieut. B. F. Rowe, R. Fus.; Temp. 2nd Lieut. F. M. Kitto, Welsh R., and to be transfd. to Gen. List; Temp. 2nd Lieut. H. G. Spearpoint, Gen. List. Lieut. S. J. Pepler, 74th Canadian Inf. Bn.; Nov. 10th. 2nd Lieut. H. Stroud, Spec. Res.; Nov. 11th.

Equipment Officer, 3rd Class.—The appointment of Temp. 2nd Lieut. (on prob.) J. Jardine, R.E., notified in the *Gazette* of Nov. 7th, is cancelled.

Experimental Officers (graded as Equipment Officers, 1st Class).—From Equipment Officers, 1st Cl., and to retain their temp. rank whilst so employed:—Nov. 1st: Temp. Lieut. (Temp. Capt.) C. E. Prince, Westmorland and Cumberland Yeo. (T.F.), with seniority from Nov. 29th, 1915; Lieut. (Temp. Capt.) A. M. Low, S.R., with seniority from Dec. 22nd, 1915.

Assistant Experimental Officers (graded as Equipment Officers, 3rd Class).—Temp. 2nd Lieut. F. C. Wilkinson, Arg. and Suthd. Highrs., and to be transfd. to Gen. List; Aug. 3rd. From Equipment Officers, 3rd Cl.:—Nov. 1st: Temp. Capt. A. G. Parsons, Gen. List, with seniority from Oct. 20th, 1915; 2nd Lieut. H. J. Poole, S.R., with seniority from Jan. 1st; 2nd Lieut. E. W. Bowen, S.R., with seniority from Jan. 7th; Temp. 2nd Lieut. J. H. Mackie, Gen. List, with seniority from May 20th; 2nd Lieut. F. A. Harper, S.R., with seniority from May 25th; 2nd Lieut. L. Mantell, S.R., with seniority from Aug. 13th.

Memorandum.—2nd Lieut. (Temp. Capt.) L. Moss, A.S.C., relinquishes his temp. rank on ceasing to be employed with R.F.C.; Oct. 30th.

Supplementary to Regular Corps.—R. H. B. Ker, from Lieut., 3rd Pioneer Bn., Canada, to be Lieut.; Dec. 2nd. 2nd Lieut. I. L. Kight resigns his commission; Dec. 2nd. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: H. J. G. Dyer, E. L. Pape, W. H. R. Skudder. The under-mentioned to be 2nd Lieuts. (on prob.):—Oct. 19th: J. A. Hutchison, F. H. Baguley, N. S. Cameron. T. Elder-Hearn; Nov. 7th.

London Gazette Supplement, December 2nd.

Flying Officers.—2nd Lieut. V. D. Siddons, Northn. R. (T.F.); Oct. 20th. Oct. 23rd: 2nd Lieut. C. D. Fellowes Staff. Yeo. (T.F.); 2nd Lieut. F. W. H. Thomas, Staff. Yeo. (T.F.); Lieut. L. L. MacLean, 8th Gurkha Rif., Ind. Army; Temp. Lieut. R. M. Wynne-Eyton, Machine Gun Corps, and to be transfd. to Gen. List; Lieut. S. J. M. White, Norf. R. (T.F.), from Machine Gun Corps; 2nd Lieut. G. E. Wilson, Sco. Rif., and to be secd. Oct. 24th: 2nd Lieut. A. W. Robinson, E. Surr. R., S.R., and to be secd.; 2nd Lieut. J. V. Tunbridge, Australian F.C.; 2nd Lieut. S. I. Winter-Irving, Australian F.C.; 2nd Lieut. R. F. Baillieu, Australian F.C. Lieut. G. C. H. Culley, Norf. R. (T.F.), from Machine Gun Corps, Oct. 25th. Nov. 9th: Temp. 2nd Lieut. W. Ross, R. W. Fus. (T.F.); 2nd Lieut. L. Butler, Yorks. L.I. (T.F.). Temp. 2nd Lieut. B. A. Taylor, Gen. List: Nov. 11th. Nov. 13th: Temp. 2nd Lieut. P. J. Barnett, R. Fus., and to be transfd. to Gen. List; 2nd Lieut. D. F. Stevenson, Sherd. Rangers Yeo. (T.F.); 2nd Lieut. (Temp. Lieut.) R. L. Whalley, E. Lanc. R. (T.F.); Temp. 2nd Lieut. (on prob.) A. C. Wyness, Gen. List; Capt. C. E. Bryant, D.S.O., 7th Hrs., and to be secd.; Lieut. J. Potter, High. L.I., and to be secd. Nov. 4th: Lieut. J. W. Boyd, 74th Canadian Inf. Bn.; 2nd Lieut. D. H. Bell, M.C., Camn. Highrs., and to be secd.; 2nd Lieut. (on prob.) W. D. B. Taylor, S.R.; 2nd Lieut. (on prob.) J. Mitchell, S.R.; Temp. 2nd Lieut. H. P. Solomon, Gen. List; Lieut. H. Kent, L'pool. R., and to be secd.; Temp. 2nd Lieut. R. L. Graham, R.A., and to be transfd. to Gen. List; 2nd Lieut. T. Ure, Sco. Rif. (T.F.); Temp. 2nd Lieut. J. Clinkskill, Gen. List, from an Equipment Officer, 3rd Cl.; Temp. 2nd Lieut. R. T. Whitney, Gen. List. Nov. 15th: 2nd Lieut. (on prob.) G. J. Scaramanga, N. Staff. R., S.R., and to be secd.; Temp. 2nd Lieut. (on prob.) H. J. Green, Gen. List; 2nd Lieut. (on prob.) T. W. L. Dickson, S.R. The appointment of 2nd Lieut. (Temp. Capt.) W. S. Farren, Hamps. Aircraft Parks, R.F.C. (T.F.), notified in the *Gazette* of Nov. 8th, is cancelled.

Balloon Officer.—Temp. 2nd Lieut. G. A. Hoghton, Gen. List; Oct. 14th.

Equipment Officers, 3rd Class.—2nd Lieut. (on prob.) R. R. Prentice, S.R.; Oct. 9th. Nov. 1st: Capt. (Temp. Maj.) R. A. Constantine, York. R. (T.F.); 2nd Lieut. (Temp. Capt.) A. Sowden, W. York. R. (T.F.); Qr.-Mr. and Hon. Lieut. H. Farquharson, Glouc. R. (T.F.); Temp. 2nd Lieut. E. Vevers, R. War. R.; Temp. 2nd Lieut. (on prob.) A. S. Poynton, R.E.; Temp. 2nd Lieut. B. E. Hobbs, Gen. List.

Supplementary to Regular Corps.—2nd Lieut. G. L. Faulkner resigns his commission; Dec. 3rd.

London Gazette Supplement, December 4th.

The under-mentioned to be Temp. 2nd Lieuts. on prob.:—

For duty with R.F.C.—Corpl. K. P. Ewart, from a Can. Divnl. Sig. Co.; Oct. 26th. Oct. 29th: Sergt. C. Dixon, from H.A.C., T.F.; Sapper J. R. Smith, from Headquarters, a Can. Divn. Nov. 5th: Sergt. H. R. Wilkinson, from Can. Mach. Gun Corps; Corpl. T. W. George, from Can. A.S.C. Nov. 6th: Qr.-Mr.-Sergt. S. McLaughlin, from Can. A.S.C.; Gunner F. H. Bronskill, Can. Fld. Arty.

Sqdn. Comdr.—Capt. D. E. Stodart, Spec. Res., from a Flight Comdr., and to be Temp. Maj. whilst so employed; Sept. 25th.

Flying Officers.—Temp. Lieut. A. H. Peck, Devon R., and to be transfd. to Gen. List; Oct. 4th. Temp. 2nd Lieut. G. E. Gibbs, Wilts. R., and to be transfd. to Gen. List; Oct. 11th. 2nd Lieut. R. L. Clegg, Lan. Fus., Spec. Res., from a Flying Officer (Observer); Oct. 18th, but with seniority from June 1st. Temp. Capt. F. H. V. Bevan, S. Wales Bord., and to be transfd. to Gen. List; Oct. 23rd. Temp. Capt. J. A. D. Dempsey, R. Ir. Fus., and to be transfd. to Gen. List; Oct. 25th. 2nd Lieut. J. Thornton, R. Scots (since decd.), and to be secd.; Nov. 8th. Nov. 10th: Temp. Lieut. G. S. Frame, R.E.; Temp. 2nd Lieut. H. F. Paton, Gen. List. 2nd Lieut. (Temp. Lieut.) R. Winnicott, Devon. R., T.F.; Nov. 11th.

Flying Officer (Observer).—The appt. of Capt. H. G. ffiske, R.F.A., T.F., notified in the *Gazette* of Nov. 3rd, is antedated to Sept. 1st.

Comdt. (graded as a Park Comdr.).—Capt. S. A. Hebden, Spec. Res., from an Equipment Officer, 1st Cl., and to be Temp. Maj. whilst so employed; Sept. 15th.

Staff Officer, 3rd Cl. (graded for pay as a Staff Capt.).—2nd Lieut. W. L. Birch, W. York. R., T.F., from a Flying Officer, and to be Temp. Capt. whilst so employed; Sept. 9th.

Equipment Officers, 1st Cl.—From the 3rd Cl. And to be Temp. Capts. whilst so empld.: Temp. Lieut. C. Porri,

Gen. List; 1st Oct. Lieut. T. W. Winter, Spec. Res.; Nov. 1st.

3rd Cl.—2nd Lieut. (on prob.) A. C. Day, Spec. Res.; Sept. 29th. (Substituted for the notification in the *Gazette* of Oct. 19th.)

Memoranda.—Sept. 22nd, 1916: The under-mentioned from R.F.C., to be Temp. 2nd Lieuts. (on prob.) for duty with the Mil. Wing of that Corps: Sergt. G. Lynch; Nov. 9th. Acting Corpl. C. G. J. Silcock; Nov. 24th.

Supplementary to Regular Corps.—The Christian names of 2nd Lieuts. Charles John Raymond Milton and John Standen Shaw are as now described, and not as in the *Gazettes* of Mar. 30th and Jan. 6th, respectively. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: R. R. Prentice, W. D. B. Taylor, P. R. Aitken, W. G. Duffield, J. Mitchell, T. Cooper, F. C. Craig, T. W. L. Dickson. J. Witt-Mann to be 2nd Lieut.; Sept. 10th. The under-mentioned to be 2nd Lieuts. (on prob.): A. C. Simpson; Oct. 10th R. H. Moore; Oct. 12th. Capt C. J. Thomsen, Australian I.F.; Oct. 23rd. S. Blackley; Nov. 9th. Nov. 16th: V. A. B. Learoyd, H. D. Lehmann. E. N. L. White; Dec. 1st.

Aeronautical Inspection Department.

London Gazette Supplement, November 29th.

A. S. Ellerton to be Temp. Hon. Capt. whilst employed as an Inspector, A.I.D.; Oct. 1st.

AIR WORK IN EGYPT.

IN the despatch published in the *London Gazette* on December 1st, from General Sir Archibald Murray, describing the operations in Egypt during the four months ending September 30th last, there are the following references to aircraft work:—

"More than half the month of July passed says the despatch without any important occurrence on the Eastern Front. On July 19th, however, the situation suddenly changed. A reconnaissance by the Royal Flying Corps revealed the fact that a large enemy force had moved westwards from El Arish and established itself on the line Bir El Abd-Bir Jameil-Bir Bayud. . . .

"I cannot speak too highly of the work of the Royal Flying Corps during the whole period. Their work was extremely arduous and exhausting. The average total daily reconnaissances during the period amounted to 23¾ hours, and during the first five days of August to as much as 31½ hours. Many pilots and observers were out two or three times a day for several consecutive days under very accurate anti-aircraft fire, and were frequently engaged in air combats with enemy machines of superior power. Special commendation is due to Lieut.-Colonel P. B. Joubert Officer Commanding Royal Flying Corps, and to Major H. Blackburn, Royal Flying Corps, who commanded the detachment at Kantara."

In the list of officers "mentioned" for their services are the following:—

"*Royal Flying Corps.*—Groves, Major (Temp. Lieut.-Col.) P. R. C., Shrops. L.I.; Carden, Major (Temp. Lieut.-Col.) A. D., R.E.; Joubert de a Ferté, Capt. (Temp. Lieut.-Col.) P. B., R.A.; Fraser, Capt. C., N. Staff. R.; Albrecht, Capt. V. A., M.C., Manch. R.; Grant-Dalton, Capt. S., D.S.O., York. R.; Jenkins, Capt. F. H., Spec. Res.; Watt, Capt. O., Australian Flying Corps; Minchin, Lieut. (Temp. Capt.) F. F., M.C., Spec. Res.; Tipton, Lieut. (Temp. Capt.) R. J., R.F.A.; Pretyman, Lieut. E. B., Som. L.I.; James, Lieut. H. H., Manch. R.; MacLaren, 2nd Lieut., A. S. C., M.C., K. O. Sco. Bord. (Spec. Res.); Coates, 2nd Lieut. W. A.; Brown, Temp. 2nd Lieut. J., R.F.A. (died of wounds); Minter, 2nd Lieut. M., Spec. Res.; West, Temp. 2nd Lieut. T. J.; Muir, Temp. 2nd Lieut. S. K.; Paris, Temp. 2nd Lieut. D. K., M.C.; McMahon, 1st Class Warrant Officer P., Australian Flying Corps; Harman, No. 222 Flight-Sergt. C. J., Australian Flying Corps; Lewis, No. 63 Flight-Sergt. A. E.; King, No. 874 Flight-Sergt. C. R.; Hunt, No. 3552 Corpl. J. S.; Roberts, No. 3201 Corpl. A.; Bacon, No. 265 1st Class Air-Mech. L. B., Australian Flying Corps; Cox, No. 3068 Corpl. A.; Holmes, No. 3094 1st Class Air-Mech. H.

SIX MONTHS AIR WORK IN FRANCE.

THE following excellent summary of the "wastage" of aeroplanes on the Western Front, as revealed by the daily official *communiqués*, was published in the *Times* of December 5th:—

"There are certain features of the official reports of the air warfare on the Western Front during November which distinguish them from those of any previous month since the Somme offensive began on July 1st. Perhaps the most curious is the sudden cessation, halfway through the month, of any mention by German Main Headquarters of aerial engagements. The last claim was made on November 11th.

"Another feature of such reports as were made in November—there were only three altogether—was their vagueness. On November 4th Main Headquarters claimed that nine, and on November 11th that 10 enemy machines were shot or brought down in air fights or by anti-aircraft guns, but not the slightest indication was given on either date of the time or place of these events. A third fact to be noted is that since the death of Boelcke at the end of October the German Flying Service has become as anonymous as the Royal Flying Corps.

"The wastage of aircraft in November was less than in any of the previous four months. According to the official *communiqués* 148 British, French and German machines are stated definitely to have been brought down, but this is not the complete total, because on two occasions British Headquarters reported that 'many others' and 'several others' beside the number mentioned were driven down. Of the definite total 32 were British—admitted by General Headquarters to have been lost or not to have returned. As an offset the British destroyed 24, captured seven, and drove down damaged 26 German machines. In addition, five other enemy aeroplanes were brought down by members of the Royal Naval Air Service operating under the French military authorities.

"The French claim 50 enemy machines. Of these, nine were destroyed, four fell into the hands of the French, and 30 were brought down in aerial fights, and, presumably, wrecked. The list of successful airmen is still headed by Lieut. Guynemer, who has scored his twenty-third victory. Guynemer has a record for 'braces' which now surpasses that achieved by Boelcke. In November alone he brought down two German aeroplanes on each of three days. Guynemer is followed by Lieut. Nungesser and Adjudant Dorme, who respectively secured their eighteenth and sixteenth 'victim' during the month.

"For the three days on which reports were made the Germans claim to have shot down 36 enemy machines.

"The following table gives the number of aeroplanes 'accounted for' since June 1st, as shown in the daily official reports of British, French and German Headquarters:—

	British.	French.	German.
June	7	28	37
July	48	31	86
August	26	42	121
September	48	68	206
October	42	25	104
*November	32	4	112
Total .. .	203	198	666"

* The figures for this month are subject to the above observations as to the incomplete German returns.

A German Claim.

A TELEGRAM sent out from Berlin on December 1st stated: "One of our submarines recently came across a damaged British aeroplane off the mouth of the Thames. The occupants of the machine, two British officers, were taken prisoners, and the aeroplane destroyed."

FLIGHT

DECEMBER 7, 1916.

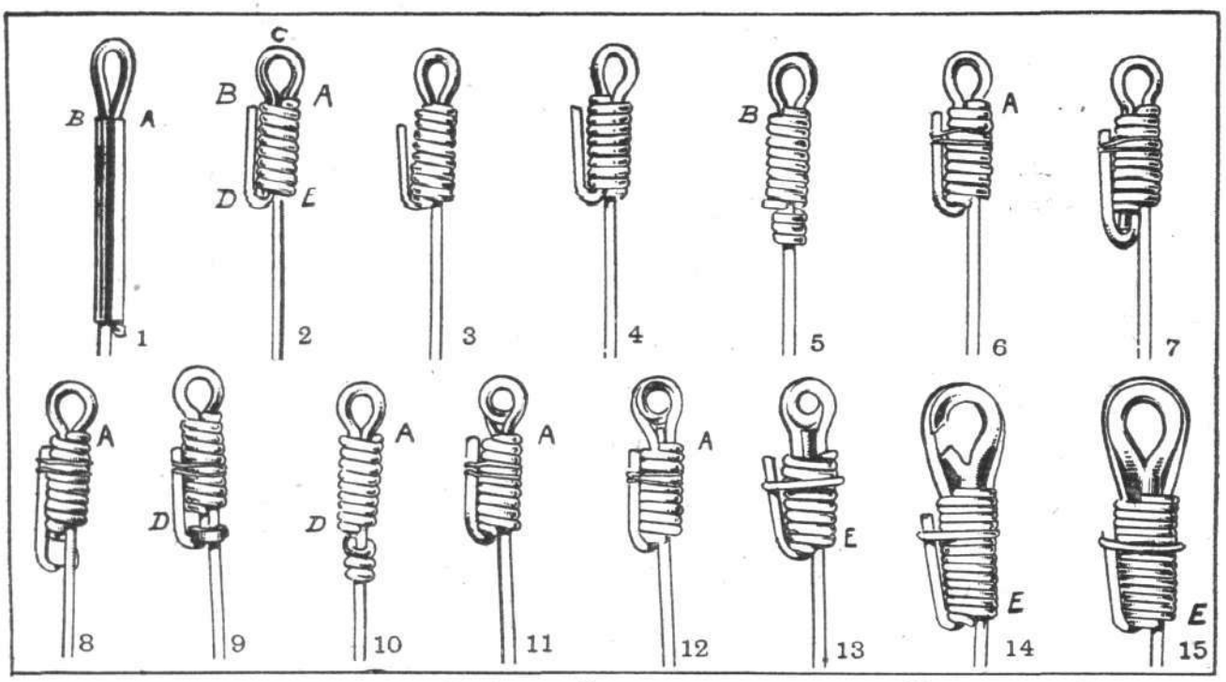
AVIATION WIRES, THEIR FASTENINGS AND CONNECTIONS.

By JOHN A. ROEBLING'S SONS CO.*

IN reference to our investigations of aviation wires and cables, their fastenings and terminal connections for stays, we have failed to find from past practice anything that would allow us to determine the best lines on which to proceed; therefore our study is not limited to any one stay design.

In making our investigation we have aimed to eliminate the use of acid and solder, imperfect bends, flattening of cable on bends, injury to wire, strand and cord due to unskilful handling of material in the field; and based on our study of present methods of manufacture of aeroplanes, we believe it is possible to manufacture the complete stay here at the factory, proof test same to 50 per cent. of its ultimate strength, measure same under stress, and therefore eliminate any uncertainty as to strength of terminal connection, length of stay and workmanship.

On this basis our research covered not only the terminal connection for shop attachment, but also a connection that would allow repairs to be made in the field without requiring the use of blow torch and solder, and from the following tests it will be readily seen that the development eliminates any doubt on this point.



We find present practice considers "the solid wire stay," consisting of one wire of suitable diameter and known to the trade as "aviation wire"; "the strand stay," consisting of either 7 or 19 wires stranded together and known to the trade as "aviator strand"; also "the cord or rope stay," consisting of 7 strands twisted together forming a rope, the strands being either 7 wires or 19 wires; and the rope known to the trade as "aviator cord."

The Solid Wire Stay.

Figure 1.

Fig. 1 shows the type most generally in use. An eye or loop is formed in tinned aviator wire and a ferrule made by wrapping a thin flat strip around both wires. The free end of the wire is then bent back over the flat ferrule, holding it in place, and the whole terminal dipped in solder. This type of terminal is far from being satisfactory. Its mechanical strength is low and variable. The process of soldering involves the possibility of establishing a source of corrosion, as well as injuring the quality of the wire. The making of such a terminal is almost necessarily a factory proposition, and provides no means for quick and efficient field replacements.

Figure 2.

The standard terminal in Europe is shown in Fig. 2. This consists of an oval spring wire ferrule applied in almost the same manner as the flat wire ferrule in Fig. 1. Particular emphasis is placed on the method of forming the eye in the stay before applying the ferrule. Radius of curve at A and B, Fig. 2, must be exactly the same as radius at C. This is called a perfect eye. No solder is used. The ferrule is made of wire of the same size as wire in stay, and is "spring" quality. Nine convolutions constitute the standard length of ferrule. The hole in the ferrule is oval, and a snug fit for the two wires forming the eye of stay. Both wire and ferrule are tin coated. The free end of the wire is bent back over the ferrule, and is not fastened in any way. This holds the ferrule firmly against the shoulder at A and B.

Tests made on stays having this type of terminal did not show very satisfactory results; 80 per cent. of the tests showed an efficiency of less than 65 per cent., the free end of the wire slipping through the ferrule at failure of the stay. In the remaining 20 per cent. of the tests the wire broke at A, the stays having an average efficiency of 68 per cent. of the total strength of the wire.

Figure 3.

Fig. 3 shows eye having radii A and B different from C, which is not allowed in foreign specifications and practice. Tests made on terminals having an eye formed as in Fig. 3 always resulted in pulling through the free end of the wire at low efficiency.

Figure 4.

In order to determine whether the direction of pitch of the spiral spring ferrule had any influence in determining the efficiency of the stay, sample terminals having left-hand ferrules as in Fig. 2 and right-hand ferrules as in Fig. 4 were made with a perfect eye in both cases, tested and compared. The left-hand ferrule clearly showed an efficiency of about 5 per cent. more than the right-hand ferrule. In testing the latter the free end of the wire slipped in every case.

Figure 5.

In Fig. 5 an effort was made to secure the free end of the wire against slipping when strain was applied to the stay by wrapping this end around the main stay wire. Tests on this construction showed an average efficiency of 72 per cent., fracture taking place at B.

Figure 6.

Another method of securing the loose end consisted of tying the end down on the ferrule with fine annealed wire,

* From the First Annual Report of the American National Advisory Committee for Aeronautics.

as shown in Fig. 6. Tests made on this construction showed an average efficiency of 70 per cent., fracture taking place at A.

CONCLUSIONS BASED ON ABOVE TESTS.

Observations made during tests of terminals 5 and 6 showed clearly that the weak points of this construction existed at B and A respectively, and that it was necessary to increase the friction between the walls of ferrule and the wire of the stay under strain to increase efficiency. Reliable information at hand showed that the same conclusions had been aimed at by foreign engineers stationed in America, and that they had solved the problem by soldering the spring ferrule terminal in the same manner that Americans had adopted with the flat wire terminal.

Horn's Improved Terminal Connection.

In an effort to avoid the use of solder with its many objectionable features, types of construction as shown in Figs. 7 to 15, inclusive, were originated and tested. In every case the spring ferrule with left-hand pitch was adopted. The loose end of wire was secured with a tie or simple wire loop or clip, as shown. Numerous tests made at intervals throughout the entire series of tests with wires having strengths of 1,600, 1,800 and 2,300 lbs., showed conclusively that there is no difference in efficiency of stays using wire of any of the above strengths.

Figure 7.

Fig. 7 shows a wedge between the ferrule and free end of wire so placed that as strain is applied to the stay and the bend in the free end of wire drawn toward the ferrule, the wedge is forced in and thus increases the friction between the wall of the ferrule and the main stay wire. Average efficiency secured, 82 per cent.; range of efficiency, 80 to 84 per cent. Fracture at A in ferrule.

Figure 8.

Fig. 8 shows two wedges with a connecting yoke. The wedges enter on each side between the two wires and force them apart and against the wall of the ferrule as strain is applied. The wedges are forced in by pressure on the connecting yoke which passes under the bend of the free end of the wire as this free end is drawn into the ferrule under strain. Average efficiency of terminal in test equals 80 per cent. Range of efficiency in tests made, 79 to 83 per cent. Fracture at A.

Figure 9.

In construction of Fig. 9 two wedges were used as in Fig. 8, but the yoke was replaced by a washer with two holes in it encircling both wires of the stay. Pressure on the wedges was supposed to be secured under strain by the drawing in of the loose end under strain. This result was not realised, as the washer became locked on the main wire and broke the loose end at D. Efficiency secured was only 70 per cent.; range, 60 to 75 per cent.

Figure 10.

In Fig. 10 two wedges were used as in Figs. 8 and 9. The free end of the wire was wrapped around the main stay wire and pushed in the wedge as initial slippage occurred. Average efficiency, 84 per cent.; range, 75 to 87 per cent. Fracture at A in ferrule.

Figure 11.

Fig. 11 shows a double eye with no wedge. Standard straight ferrule with free end tied. This type of eye could only be used on stays when turnbuckles or hooks to be attached had open eye. Average efficiency in test, 80 per cent.; range, 74 to 82 per cent. Fracture at A.

Figure 12.

Fig. 12 again shows a double eye in stay with a single wedge between wires on the eye end of the ferrule. As ferrule is drawn down against shoulders A and B, the wedge is forced in. This increases friction of wires against ferrule at A and B, but not at D and E. Average efficiency, 85 per cent.; range, 80 to 87 per cent. Fracture at A.

Figure 13.

Fig. 13 shows a construction consisting of a double eye in stay, a single wedge under the eye, and an oval spring wire ferrule tapered at the same angle as the wedge. In this case the pressure of the wedge forces both wires throughout the entire length of the ferrule against the walls of the ferrule, and this increases friction on the ferrule uniformly as the strain increases on the stay and reduces the strain at the weak points A and B proportionately. Fracture always took place at E. Average efficiency, 94 per cent.; range, 92 to 95 per cent.

In Fig. 13 we have the most efficient terminal tested. It has none of the objections of a soldered terminal. It is simple, parts are inexpensive, strong and few in number. It is an ideal terminal for emergency use in the field.

Figures 14 and 15.

Figs. 14 and 15 show modifications of this type to overcome any objections which might be raised to the double eye. The wedge and a substantial thimble are combined in one piece. To secure more points of contact, and consequently greater friction, and also for greater flexibility, the taper ferrule is made of finer wires and with more convolutions. The wedge thimble may be open or closed, as desired. Fracture took place at E. Average efficiency, 94 per cent.; range, 92 to 96 per cent.

Summary of Tests for Efficiency.

Terminal.	Average efficiency.	Range of efficiency.	Points of fracture.	Remarks.
	Per cent.	Per cent.		
1 ..	80	60–90	A or B	American, soldered.
2 ..	65	60–75	A or slipped	Foreign, proper eye.
3 ..	62	60–65	Slipped	Foreign, improper eye.
4 ..	60	59–61	Slipped	Right-hand ferrule.
5 ..	72	65–75	B	End wrapped around stay.
6 ..	70	68–78	A	End tied to ferrule.
7 ..	82	80–84	A	Wedge under hook.
8 ..	80	79–83	A	Two wedges with yoke.
9 ..	70	60–75	D	Two wedges with washer
10 ..	84	75–87	A	Two wedges end wrapped.
11 ..	80	74–82	A	Double eye, no wedge.
12 ..	85	80–87	A	Double eye, one wedge.
13 ..	94	92–95	E	Tapered ferrule, double eye, wedge.
14–15	94	92–96	E	Thimble wedge T. F., single eye.

Note.—These tests were made with wire having a diameter of 0·102 inch and a strength of 1,600, 1,800 and 2,300 lbs. No difference in efficiency of stay was found by using wire of any of these strengths.

"X 54" Raid, November 27th–28th.

German Version.

Berlin, November 28th.

"On the night of Nov. 27th–28th, several naval airships successfully bombed blast furnaces and industrial establishments in Central England. At several places conflagrations were observed. The defence was extraordinarily powerful. One airship fell to hostile anti-aircraft, and came down near Scarborough. A second airship has not returned, and she must be considered lost. The other airships have returned, and have landed.—(Signed) CHIEF OF ADMIRALTY STAFF."

R.F.C. Observers and Promotion.

AN Army Order, issued with the December Orders, states that:—

"It has been decided that, in future, officers who have qualified as observers with the Royal Flying Corps in the field may, within the authorised establishment, be appointed Flying Officers (Observers) instead of passing through the intermediate grade of Qualified Observers.

"As Flying Officers (Observers) they will receive pay at the rate of 12*s.* a day, and flying pay at 5*s.* a day under Article 226A, Pay Warrant, will be issued continuously while employed as observers in an area of active operations.

"It has also been decided that officers so appointed shall take their places in the list of Flying Officers from the date on which they embark for overseas in the case of officers joining at home, or from the date of joining the Royal Flying Corps in the field in the case of those obtained locally. This will give them seniority in the Corps as Flying Officers, but they will not be entitled to receive pay as Flying Officers (Observers) prior to the date of qualification.

"Whilst serving as observers on probation they will receive flying pay at 3*s.* a day, under Article 226A, Pay Warrant."

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

New Members.

IN accordance with the rules, the Annual Subscription of any New Member who is elected between November 1st and December 31st of this year, will cover the period up to December 31st, 1917.

Suspension of Entrance Fees of New Service Members.

Until further notice, Service Members will be elected to the Royal Aero Club without Entrance Fee.

New Club Premises.

The arrangements for the alterations, decorations, furnishing, &c., of the New Club House are in the hands of a special Committee, and the work is progressing very satisfactorily. There will be a billiard room, smoking lounges, buffet, reading and writing room, dining room and bedrooms. The house is situated within three minutes' walk of the present Club premises.

THE FLYING SERVICES FUND administered by THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The Fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers, and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 166, Piccadilly, London, W.

Subscriptions.

	£	s.	d.
Total subscriptions received to Nov. 28th, 1916	11,018	19	8
Collected at the Westland Aircraft Works, Yeovil (Fifty-ninth contribution)	0	16	2
A. Dukinfield Jones	5	0	0
L. M. Argall, A. R. Weekes, R. K. Weekes ..	0	13	0
F. E. Rosher: First instalment of half the royalties on sale of Flight-Lieut. Harold Rosher's Letters	50	0	0
Total, December 5th, 1916	11,075	8	10

166, Piccadilly, W. B. STEVENSON, Assistant Secretary.



The Car.

No. 3, Clifford Street, New Bond Street, W. The new premises of the Royal Aero Club.

THE ROLL OF HONOUR.

REPORTED by the War Office:—

Killed.

Lieut. G. L. Colomb, London and R.F.C.
2nd Lieut. P. McC. Haarer, R.F.C.
2nd Lieut. A. C. Laird, Black Watch and R.F.C.
Lieut. N. Hargreaves, E. Lancs. and R.F.C.

Previously reported Missing, now reported Killed.

Capt. A. Skinner, S. Lancs. and R.F.C.

Wounded.

Lieut. F. A. George, Northumberland F., attd. R.F.C.
Lieut. A. L. Harrow-Bunn, Sherwood For., attd. R.F.C.
Lieut. W. E. Hazelton, W. Yorks., attd. R.F.C.
2nd Lieut. B. H. M. Jones, R.F.C.
Lieut. A. P. Maurice, A.S.C., attd. R.F.C.
2nd Lieut. F. S. Moller, R.F.C.
2nd Lieut. E. P. Roberts, R. Sussex and R.F.C.
Capt. G. L. Watson, W. Yorks. and R.F.C.
2nd Lieut. E. G. Whelon, R. Sussex and R.F.C.
2nd Air Mech. A. L. Maude, R.F.C.

Previously reported Missing, now reported Wounded and Prisoner of War in German hands.

2nd Lieut. R. Wood, W. Yorks and R.F.C.

Missing.

2nd Lieut. H. B. Begg, R.F.C.
2nd Lieut. B. W. Blayney, R.F.C.
2nd Lieut. W. B. Clark, Yeomanry and R.F.C.
Lieut. R. Corbett, Yeomanry and R.F.C.
2nd Lieut. J. T. Hanning, R.F.C.
Major L. G. Hawker, V.C., D.S.O., R.E., attd. R.F.C.
Capt. G. A. Parker, Northampton, attd. R.F.C.
Lieut. V. A. Strause, A.S.C., attd. R.F.C.

Previously reported Missing, now reported Prisoners of War in German hands.

2nd Lieut. R. C. Dingley, Worcester, and R.F.C.
2nd Lieut. C. Kennard, R.F.C.
Lieut. J. B. Lawton, Buffs (E. Kent), and R.F.C.
2nd Lieut. N. Middlebrook, Rifle B. and R.F.C.
4043 2nd Air-Mech. B. Digby, R.F.C.
2173 Sergt. G. J. Morton, R.F.C.

It has been unofficially reported that Capt. R. J. Lillywhite, R.F.C., the well-known Hendon pilot, has been killed in an aeroplane accident at the front.

AIRISMS FROM THE FOUR WINDS.

GENERAL SIR ELLIOTT WOOD'S utterances should always be given heed. But we are sorry to see that he has laid down in such very *ex cathedra* manner that all lighting—or, rather, the reverse—regulations should at once go by the board and let every mother's child in the country do as he or she jolly well pleases about subduing or increasing their lighting arrangements. The only argument put forward by the General against the so-called silly regulations in force is that if anybody in the country likes to take the risk, why shouldn't they? But there are others, surely, General? How about residents near at hand or in adjacent villages? Are they to have no voice in the matter? After all the Zepp. pirate is, whatever his intentions may be, not positively famed for accurate pilling, and judging by past experiences his missiles usually hit anything except what they are supposed to be aimed at. Again, the rest of the occupants of the General's own house may not be quite in accord with his Dictatorship's views, and would certainly be in a bit of a quandary as to whether to take their risk against their better judgment, to protest meekly, or pack up their traps and get clear of the danger zone. It would be curious to see the result of a secret ballot—for and against—of all those concerned in the General's household and the adjacent neighbourhood.

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A propos of this question, a timely little leaflet has been issued by the Postmaster-General, drawing attention to the necessity for the renewal of the Government Air Raid Insurance certificates for household goods, &c. (not exceeding £100 in value). Holders of expiring policies desiring to obtain the continued benefits of the scheme should see to obtaining one forthwith from their local post office.

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IT was but a natural outburst of enthusiasm the other night at the Alhambra Theatre, when the audience learnt from the manager that Lieut. Louis Noel was sharing with them the enjoyment of the entertainment. Quite a gathering of old Hendon favourites was with the hero of the Salonica–Sofia–Bucharest flight, including Mr. Claude Grahame-White, Capt. B. C. Hucks, Lieut. Tuck and M. Osipenko, the intrepid Russian pilot, besides Sir William Bull and Mr. Alan Burgoyne, M.P. The impromptu "extra turn," finishing up with the "Marseillaise," was a pleasant interlude for shortening the interval.

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ONCE again, as apparently General French's assurance has not yet got home, it has been thought desirable to officially inspire confidence in the general public as to the arrangements in force for deceiving the Hun enemy from above, being adequate. Major-General Sir Francis Lloyd takes up the theme this time, in response to an inquiry from the Southwark Council. Sir Francis says:

"All possible steps are taken for protecting life and property in London on occasions of attack by aircraft, and only such lights are permitted on railways and tramways as are absolutely necessary to ensure the continuance of traffic, which is of the greatest national importance.

"From observation made it is interesting to note that sparking from electric trains and trams tends rather to confuse than to assist hostile aircraft in finding their way over London.

"Further, it is not considered desirable to issue public warnings of impending air raids or to notify the public when the danger is past."

It is to be hoped Londoners will assimilate these conclusions and be content to just go on blundering along in darkness for the next five or ten years of the war, and thus give our officials a chance to get a move on in other quite as important directions.

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LONDON after all is lucky by contrast to some other towns in this little island of ours. Away up north-east one man last week captured "21 days without" for lighting a match in the street just when a Zepp. in the vicinity was looking for this form of beacon, while another miscreant escaped the court minus 40*s*. Perhaps the latter's was only a little one.

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THE effect in neutral countries of the Zepp. London raids may be reasonably gauged from the following view, just by way of sample, of the *New York World*:—

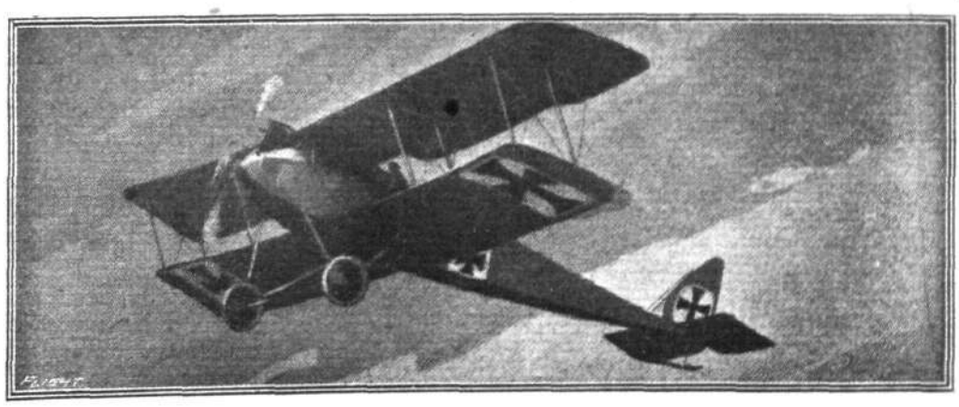
"After the destruction of six air machines in the last three months' raids over England, even the Germans must question their value, except for limited operations. As eyes for the fleet they have been used to good purpose, but for attack, even under favourable conditions, they are not nearly so formidable as had been thought. The belief that they were destined for a campaign of terrorism against England was fondly cherished in Germany, but they have not inflicted any serious damage, and the whole business has been rather futile except for stimulating recruiting in Great Britain and provoking reprisals."

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STILL another attempt is to be made in London to open up the aircraft raid damage question. The Lord Mayor has this time been appealed to by business citizens to intervene, by presiding at a Mansion House meeting, at which the views of the City are to be expressed in a resolution urging the Government to "abandon the insurance scheme and agree to compensate sufferers out of national funds."

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WHATEVER the Government may think about it, some of the naval and military authorities are desirous of letting the



The German Halberstadt single seater, of which a good deal has been heard lately.—This machine, it will be noticed, has Morane type *fuselage* and tail planes. The large stationary engine is fairly effectively cowled in so as to reduce head resistance. Although being a comparatively small machine it has two pairs of struts on each side, probably necessitated by the large, heavy engine. This is one of the types with which the German pilots are getting some of their own back for our air ascendancy during the past.

Parliamentary Air Committee obtain an insight into the effectives of the Air Services. Some 80 members of the Committee last week had a look around at one of our important naval bases, where they had not only a sight of things, but were initiated into practical seaplane work, and were duly impressed in more ways than one.

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ZEEBRUGGE raiding has become a little more open, but there is enormous room for development, now that past obstacles have been overcome. With a really free hand, oh! what a surprise it would be to a lot of folk to see what they would see.

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IT is always illuminating to get the other fellow's views, and therefore the following account of the Allies' air attacks on South Germany, as given by *Flugsport*, is of interest in many ways. On October 12th, between 3 and 5 in the afternoon, the story runs, several squadrons of hostile aeroplanes—between 40 and 50 machines in all—dropped bombs on Donaueschingen, Allmenshofen, Hüfingen, Eschweiler, Haslach and Rottweil, without, however, doing any damage of military importance. Private property was damaged to a certain extent, and a few civilians were slightly injured. The total number of casualties is 26. Of the attacking machines, nine were brought down by our pilots and anti-aircraft guns, one of these being English. The inhabitants of Bremgarten, many of whom were working in the fields, had a specially exciting time. For the third time they witnessed how hostile aeroplanes were forced to land on village fields. The French machine was pursued by several German aeroplanes, and was finally compelled to land. Both occupants were slightly wounded, and were taken prisoners by the crews of three German machines which had alighted near by. The bombs on board the French machine exploded, and the French aviators warned the population not to go near the machine. In Freiburg an English aeroplane was hit by anti-aircraft guns and forced to land. In spite of a severe wound in the head the pilot had the presence of mind to glide down into the Freiburg training ground. The officer was taken to hospital. A second machine was shot down between Lehen and Hugstetten, while a third fell in flames near Haslach after a fight. Both occupants were dead. Yet another machine was forced to land at Iringen, while two others came to grief at Breisach. Two more came down at Krotzingen and Müllheim respectively. In the latter was found an English naval officer.

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THE following summary of the machines brought down is given by *Flugsport* :—

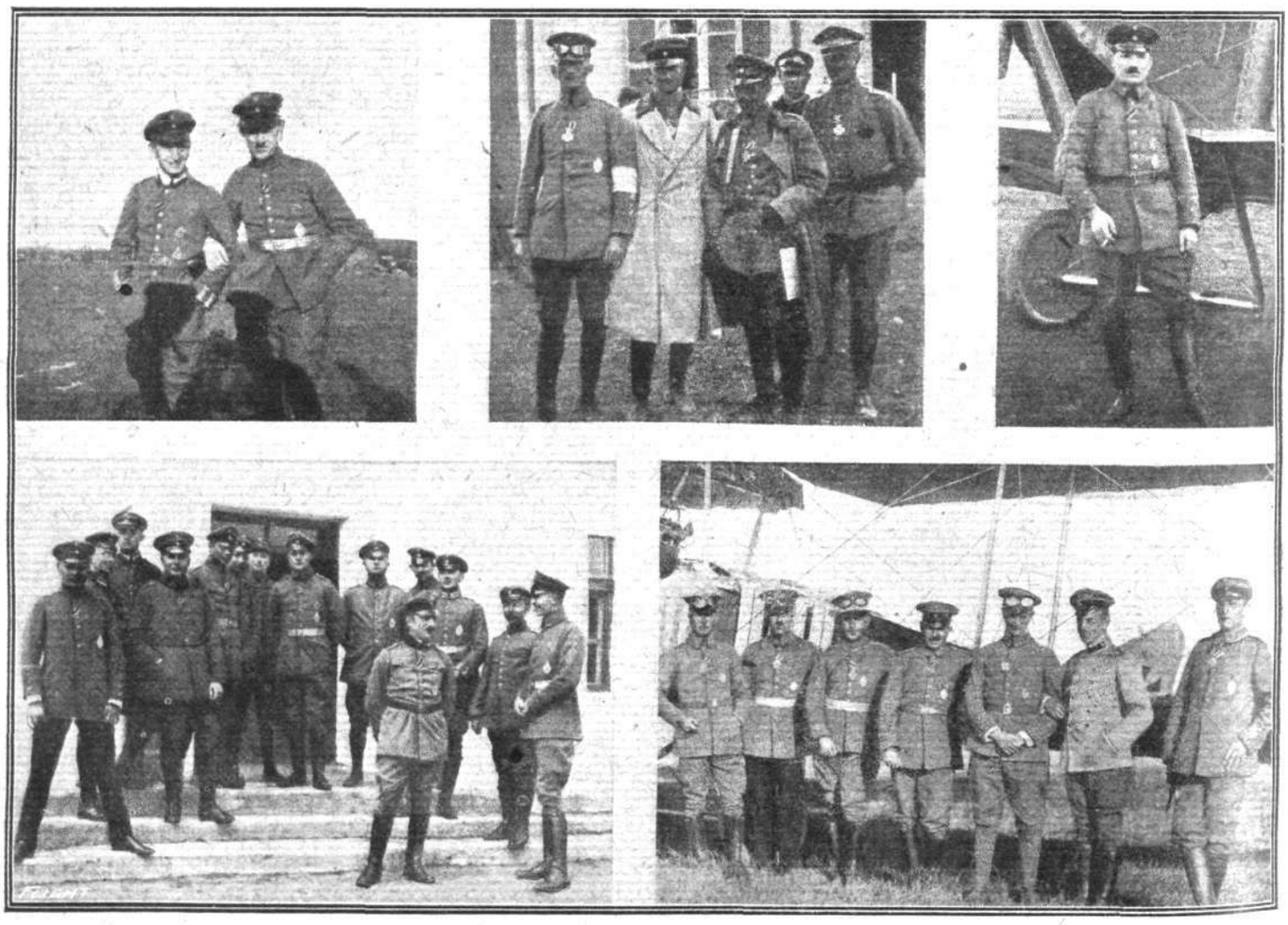
" Farman biplane. Motor: Renault, No. 54394. Occupants: Pilot, Adjutant Baron; machine gunner, Sergt. Andre Guerineau. Both dead. Shot down in air fight at Widensolen, near Neubreisach.

" Farman biplane. 130 h.p. Renault, No. 55469. Occupants: Pilot, Armand Georges; machine gunner, Ernest Jouan. Both dead. Shot down in air fight at Ihringen, near Neubreisach.

" Breguet biplane, No. 534. Motor, 220 h.p. Renault, No. 5477 (12-cyl.). Occupants: Pilot, Lieut. Rockey; bomber, Sergt. Sterdec. Both taken prisoners. Shot down in air fight at Oberenzen, near Colmar.

" Breguet biplane IV, No. 229. Motor: 220 h.p. Renault, No. 54561. Both occupants dead. Shot down in air fight at Rüstenhart, near Neubreisach.

" Breguet biplane IV. Motor: 220 h.p. Renault. Occupants: Pilot, Sergt. Bouot; bomber, Delcroix. Both taken



SOME MORE GERMAN PILOT RECIPIENTS OF THE 430,000 ODD IRON CROSSES.—Top photos., left: Lieuts. Reinhardt and Zahn. Centre: Capt. von Jena, Capt. Scholi, Major von Loeben, Count Schall. Right: the well-known pilot Ingold. Bottom photos., left: (names not given by *Flugsport*). Right: Lieuts. Saenger, Baas, Hahn, Pilot Ingold, Lieuts. Hug and Bremer, Sergt. Reichert.

prisoners. Shot down in air fight at Bremgarten, near Müllheim.

"Sopwith biplane A1, No. 9660. Captured intact. Motor: Clerget, No. 260. Occupant: Sub-Lieut. Bukerworth. Wounded, taken prisoner. Shot down in air fight over Freiburg Aerodrome.

"Breguet biplane, No. 538. Motor: Renault, No. 49501. Occupants both dead. Shot down in air fight at Umkirch, near Freiburg.

"Breguet biplane, No. 436. Motor: 12-cyl. Renault, S. VI., No. 358. Occupants: Pilot, Sergt. Mottay, taken prisoner; bomber, Corpl. Marchand, dead. Shot down in air fight at Steinbach (on the Haslach–Offenburg railway line).

"Breguet biplane, No. 9176. Motor: 220 h.p. Renault, No. 54281 (12-cyl.). Occupants: Pilot, Lieut. Neumann, prisoner; bomber, Sergt. Vitty. Shot down by anti-aircraft guns at Buggingen, near Müllheim."

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To this list, editorial comment says that what is specially interesting is the fact revealed in this connection, that an American squadron took part in the raid, and thereby lost a number of the best American pilots, such as Norman Prince, one of the founders of the American Flight League in France, and Pilots Chapman and Rockwell. How *Flugsport* learnt this "fact," however, does not emerge, as neither of the names appear in their list. Equally interesting is the fact that France lost one of her crack pilots of the moment, Adjutant Baron.

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IN one of the Prussian casualty lists the names of several well-known aviators are contained, one of which may be mentioned, Capt. Günther von Detten, who will be remembered in connection with pre-war races in Germany.

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DURING the night of September 6th the works of the Luftfahrzeug-Gesellschaft, at Adlershof, were burned down. It is thought that incendiarism is out of the question. As far as can be ascertained only six or seven complete machines were burned, and about ten *fuselages*. All other machines, models, templates and jigs are said to have been saved. Arrangements have been made to carry on work elsewhere.

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THE German flying ground at Halten, which has not been in use for some time, is now occupied by the Deutsche Fliegerschule, tuition being given on Albatros biplanes, under the instruction of the German pilot, Hausmann. The one-time Eichwalde Flying School has been taken over by the Zentrale für Aviatik in Johannisthal. Special courses in the theory as well as practice of flying have been established, the latter being in the hands of instructors Krüger and Schroff. Albatros and Rumpler biplanes are being used.

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THE aircraft works of the Gothaer Waggonfabrik have been transferred from Gotha to Staaken, near Spandau, where in future the construction of the well-known Gotha seaplanes will be carried out.

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ARRANGEMENTS are being made, and are said to be nearly complete, to create a new concern for the construction of aeroplanes and motors. Some German business men and one of the large banks in Buda-Pest are responsible. The new firm, if it materialises, is to have its works at Komitat Somogoy, on the Balaton Lake (Plattensee), Hungary, where, it is thought, the conditions will be almost ideal for the manufacture and testing of seaplanes. The capital is reported to be "several" million marks.

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A NEW firm has been established in Hungary for the manufacture of aeromotors, under the title, after allowing for the native vernacular, of "The Ganz-Fiat Hungarian Aeromotor Works, Ltd." It is to be run in conjunction by the Ganz and Co. Danubius Machine-, Coach- and Shipbuilding Co., Ltd., and the Austrian Fiat Works. The capital of the new limited company is put at a couple of million crowns.

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THE ZEPP. BOGEY.—MOTHER (*seizing recalcitrant son by the nether garment*): "Now then, young Albert, you come indoors."

HERO: "No—o! Wants to see Zeppelins."

MOTHER: "'Ere, if you ain't a good boy I'll tell the Zeppelins not to come any more."—*Punch.*

TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister Journal) of December, 1906. "FLIGHT" was founded in 1908.

M. SANTOS DUMONT'S NEW AEROPLANE.

M. Santos Dumont is not disclosing much in the way of particulars about his new machine. That it is to be provided with a 100 h.p. motor we already know, and he has now vouchsafed the information that the wings will be considerably smaller than in the first machine, which he now regards as purely experimental. Other details of construction are not forthcoming, but he anticipates that he will be able to attain a speed in the new machine of 120 kiloms. per hour.

AN ANTOINETTE AEROPLANE.

The Antoinette Co. are building an aeroplane, to carry two persons, the joint design of Capt. Ferber and M. Levavasseur, to be equipped with one of the Levavasseur motors. The aeroplane is to be manipulated by Capt. Ferber, and we gather that the Antoinette Co. are prepared to build aeroplanes as a regular thing for all who wish to experiment personally.

"LA PATRIE."

There is little further news of "La Patrie," excepting that having been taken over by the military, she is now entirely in the hands of professional soldiers, and on the 28th went out with Captain Voyer as pilot and Lieut. Bois as assistant pilot, and the mechanics Duguffroy and Rey. The airship went out at 10.18 in the morning, and concluded the ascent at 11.20, being thus 1 hr. 5 mins. in the air.

LENGTHY BALLOON JOURNEY.

A balloon journey of 402·46 miles in 16 hours was accomplished by Mr. Leslie Bucknall, who left Wandsworth Gas Works on Tuesday afternoon in last week in his balloon, "Vivienne IV," passed over Rye in Sussex, crossed the Channel at Le Touquet, passed over Amiens, Reims and Chaumont during the night, and descended ultimately at Nevy les Dole, in Switzerland, at dawn on Wednesday morning.



FROM THE TURKISH FRONT.—Capt. Buddecke in front of his machine. Note the Flying Corps uniform and the Iron Cross.



IF it were not that I know this weather brings discomfort to those who are fighting for our liberty on land and sea, I could welcome the present cold snap. With Christmas but three weeks ahead, it is seasonable to see the hoar frost on the bushes and trees, turning familiar spots into scenes upon which one may gaze as though on a new land. This morning the air was clear and brisk. The golden light from the rising sun was reflected from the rime on every twig until the whole was a-glitter. It was the sort of morning when one has a distinct inclination to curtail the early splash, or even not to splash at all, but to compromise with a jug of water drawn from the tap that has direct communication with the kitchen boiler.

The breakfast room is cosy with its hour-old fire, the toast is cooling in the rack, and from somewhere which is prohibited area to the king of the castle comes the appetising smell of frizzling bacon. All very nice and comfortable and comforting and enervating to the man in the early forties, who may soon have to get into training to follow on the heels of those who have already crossed the silver streak into a land of hardship. For England is getting ready to start fighting, and none may tell to what extent the age limit may be extended, even if there be a limit fixed that shall be mentioned in figures. It is possible that the limit may be one of bodily fitness, with age hardly considered. Soon some of us may have other reasons to know that England is at war, besides the grumblings from the kitchen about the scarcity of sugar.

This morning the aeroplanes were sailing overhead. Mornings have passed, misty, foggy mornings, when flying was an impossibility, and this morning the machines were roaring around, frisking in the early sunshine, their pilots putting them through all the evolutions at command as though it were a treat to be alive and get away up into the clear air for a kick and a gambol.

And I wondered whether the pilots were cold. Whether up there in the frosty morning air, through which they were being whisked at 80 miles or more an hour, it was not eating into their very bones, and freezing them stiff. It is cold, doubtlessly, but I have seen pilots descend from these jaunts into the upper air, and spring from their machines with rosy faces and smiling lips. It is cold without a doubt. Should you ask one of these flyers, he will tell you so, probably with a suitable adjective attached, but he will rub his hands and stamp his feet, and then peel off his greatcoat and tuck it under his arm.

I doubt whether any one of those far above my house this morning was anything like as cold as I was during the few moments I stood in my garden to watch them, and I wondered why, with a fairly good guess at the answer.

Talking the matter over in the train, from the windows of which we could still see some machines circling above, my usual travelling companion admitted that pilots did not feel the cold as we did because they were used to it, but could not be brought to see that it would be a great deal better for many more of us if we could get used to it, or in other words, become more healthy.

Fact of the matter is, there is too much indolence. Too much of standing astride the hearthrug. Too much rushing from warm rooms into warm trains, and from warm trains into warm offices. I have known people, although you may not believe it, who every winter have pasted strips of paper round the window frames, yet those nearly dead with consumption can sleep out on the open verandas of hospitals.

Of course all this must lead up to a yarn. I knew a man who was always getting bitten by the microbe responsible for new ideas. Ordinarily, he was a respectable citizen of normal habits, but when the germ of any new crank idea got into his brain, he would go for it hot-foot. The first symptoms of his lapse from the path of sanity were heralded by his suddenly found conviction that a hat was an absurd innovation of human foolishness. Winter put a time limit on his idea that nature sent us into this world exactly as we were intended to dress, and he argued that in any other country but this it would have been all right, but that here we must take artificial means to protect ourselves. This period embraced double underclothing, bodybelts, knitted waistcoats, overshoes, and somebody's malted extract of oil taken three times a day At times he was a vegetarian. His family had a lovely time, for like all converts to anything new, he must take all along with him. Finally he got the idea that they should all sleep in tents in the garden. One night was sufficient for his wife to present her ultimatum so far as she and the children were concerned, but he stuck to it for nearly a week, and would probably have continued right through the winter except for the fact that he was in his proper bed when the doctor came, and by the time he got well enough to think of anything in particular, he was off on a new stunt. I knew another man who before the war filled himself half full of medicine every winter morning, and wore clothing enough for three. Joining the G.R.s early after their creation, he has passed two years of hard training, including sentry go half the nights in the week, bucked up by trench digging every Sunday. I saw him yesterday looking the picture of health. He has put on weight, never wears a topcoat except his uniform one when on duty. He works from 10 to 12 hours every day in the city, and when I saw him outside the Royal Exchange he laughed at me for saying it was cold.

And of course all this should lead up to a moral, but as it might not adorn a tale I will not point it —unless I have already done so.



Casualties.

Lieutenant GEORGE LUSHINGTON COLOMB, London Regiment and R.F.C., killed in action on November 22nd, was the second and only surviving child of Mrs. Maud Colomb and the late William R. Colomb, of Rossleigh, Greystones, Ireland. He and his elder brother, Mervyn, were educated at Haileybury, and both enlisted in the London Regiment on the outbreak of the war. They fought as non-commissioned officers at Ypres and at Neuve Chapelle, where they were wounded. The elder brother, who had just received his commission, died of his wounds. Lieutenant George Colomb received the D.S.M. for his gallantry in rescuing wounded comrades, and his commission. After serving some time with the depôt at home, he joined the R.F.C., and had been five weeks at the Front and had taken part in one successful engagement when his machine met with the accident which caused his death at the age of 20.

Lieutenant E. H. HALL, Duke of Cornwall's Light Infantry, attached R.F.C., killed accidentally on November 27th whilst flying, was the eldest son of Mr. and Mrs. Percy H. Hall, of Caterham, Surrey. He was aged 24.

Captain C. E. P. HENDERSON, Royal Field Artillery (killed in action on November 17th, while commanding his battery), was twenty-nine years of age, and was educated at Radley and Woolwich, entering the Royal Artillery in 1906. Captain Henderson was a balloonist, French interpreter, and held the Royal Aero Club certificate. He served in France from September, 1914, until his death, and was present at the battles of the Aisne, the Marne, Ypres, and La Bassée, and along the line to Vermelles, Loos, Hulluch, and Hohenzollern, commanding his battery at the last three battles and receiving the Cross of the Legion of Honour. He commanded his battery again right through the Somme Battle, and his name was sent up three times this year for the M.C.

Second Lieutenant ERNEST STANLEY PATRICK HYNES, R.F.C., killed on November 10th, aged 18, as the result of an accident while flying on duty, was the youngest son of Mr. H. H. Hynes and the late Mrs. Hynes, of Penmorvah, Penzance. He was educated at Rosslyn House and Price's School, Fareham, and entered the R.F.C. through Sandhurst, being gazetted to the Buffs. He left for the Front on September 20th last.

Lieutenant J. M. J. KENNY, R.F.C. (killed in action on September 23rd), was twenty years of age, and son of the late Patrick J. Kenny, solicitor, Waterford. He had a commission in the Army Service Corps in April, 1915, and, transferring to the Royal Flying Corps, was gazetted flying officer in the September following; he was promoted in May of this year.

Sub-Lieutenant ALFRED ROBERT KNIGHT, R.N.V.R., killed on November 13th, was formerly in the Armoured Car Section of the R.N.A.S., but was transferred to the R.N.D. Before the outbreak of war he was a member of the staff of the Bank of Montreal, London. The only child of Mr. Knight, Ashford, Kent, he was educated at the Grammar School, Ashford.

Second Lieutenant ANDREW C. LAIRD, the Black Watch and R.F.C., killed, was the youngest son of Mr. and Mrs. John Laird, of Balmoral Place, Crosshill, Glasgow, and was 22 years of age. He joined the Glasgow Highlanders at the outbreak of war, received a commission in the Black Watch in June, 1915, and was transferred to the R.F.C. in August, 1916. Before the war he was employed by John Laird and Sons, Ltd., wholesale stationers, Glasgow.

News has been received of the death of Captain ROBERT JOHN LILLYWHITE, R.F.C., in an aeroplane accident at the Front, at the age of 23. He was a nephew of Lillywhite, the famous Sussex cricketer, and his father was for many years in the service of the Duke of Richmond, on his West Sussex estate. He originally entered the Navy, but was discharged for medical reasons. Taking up aviation, he was one of the first to obtain a pilot's certificate under the new rules. Engaged as flying instructor in the R.F.C., he served in Egypt, and in 1915 was transferred to another front, where he obtained a Lieutenant's commission. Injured in a motor accident early in this year, he returned home to recuperate. During this period he carried out duties as inspector of aerodromes and lecturer. In September he was promoted Captain.

Second Lieutenant CHRISTOPHER MONCKTON, Royal Irish Fusiliers, attached R.F.C., previously unofficially, now officially, reported killed, was the elder son of Mr. Arthur Monckton, J.P., Normanston Hall, Oulton, Lowestoft, and a grandson of the fourth Earl of Radnor. He joined the 3rd Battalion Princess Victoria's at Buncrana in September, 1915.

Missing.

Lieutenant TREVOR MOUTRAY BENNET, M.C., Royal Irish Rifles, attached R.F.C., who is officially reported missing, is a son of Mr. James Bennet, University Road, Belfast. He was educated at the Royal Belfast Academical Institution, and was a member of the Ulster Volunteer Force.

Captain SIDNEY EDWARD COWAN, M.C., R.F.C., Special Reserve, reported missing, is a son of Mr. P. C. Cowan, D.Sc., M.Inst.C.E., Chief Engineering Inspector of the Local Government Board. Captain Cowan, who is 19 years of age, was born at Downpatrick.

Major LANOE GEORGE HAWKER, V.C., D.S.O., Royal Engineers, attached R.F.C., reported missing, is a son of the late Lieutenant H. C. Hawker, R.N., of Home Croft, Longparish, Hants, and was born in 1890. He was educated at the Royal Naval College, Dartmouth, and the Royal Military Academy, Woolwich, and entered the Royal Engineers in 1911. During the present war he has acted as Flight-Commander of the R.F.C., and has received mention in despatches, as well as the D.S.O. and the V.C. Major Hawker won the Victoria Cross on July 25th, 1915. The official record of his deed is as follows: "When flying alone he attacked three German aeroplanes in succession. The first managed eventually to escape, the second was driven to ground damaged, and the third, which he attacked at a height of about 10,000 ft., was driven to earth in our lines, the pilot and observer being killed. The personal bravery shown by this officer was of the very highest order, as the enemy's aircraft were armed with machine guns, and all carried a passenger as well as the pilot." The D.S.O. was conferred upon Major (then Lieutenant) Hawker for an exploit of which the following is the official record: "For conspicuous gallantry on April 17th, 1915, when he succeeded in dropping bombs on the German airshed at Gontrode from a height of only 200 ft. under circumstances of the greatest risk. Lieutenant Hawker displayed remarkable ingenuity in utilising an occupied German captive balloon to shield him from fire whilst manœuvring to drop the bombs."

Married and to be Married.

The marriage arranged between Flight-Commander J. H. LIDDERDALE, R.N., and MAUD, youngest daughter of Mr. and Mrs. J. HANSON WALKER, 2, Queen's Elm Square, Chelsea, will take place on Saturday, December 16th, at St. Peter's, Cranley Gardens, at 2.30.

An engagement is announced between Second Lieutenant AUSTIN E. NEAL, R.F.C., son of the late Mr. Thomas Neal, of Spondon, Derby, and MILLICENT GERTRUDE, only daughter of Mr. H. A. COUCHMAN, Shobnall Grange, Burton-on-Trent.

An engagement is announced between Flight-Lieutenant J. FORGAN POTTS, R.N., son of Captain and Mrs. W. F. Potts, of Bombay, and LUCETTE, daughter of Commander

BULTINCK, delegate of the Belgian Minister of Marine in London, and of Madame A. BULTINCK, 67, Onslow Gardens, South Kensington.

The marriage arranged between Captain ALISTER F. KEBLE WHITE, Suffolk Regiment and R.F.C., eldest son of the Rev. A. and Mrs. Keble White, of Chevington, Suffolk, and DORIS FREDA, only daughter of Lieutenant-Colonel W. T. PRETTY, T.D., D.L., and Mrs. PRETTY, of Goldrood, Ipswich, will take place quietly at St. Mary Stoke, Ipswich, on December 20th, at a quarter-past two o'clock.

Items.

Flight Sub-Lieutenant PULLING, who has been decorated in connection with the Zeppelin fight on the Norfolk coast, is an old boy of St. Anne's, Redhill. He is Devonshire born, and before receiving his commission in August last year was in the Government wireless service.

Lieutenant EGBERT CADBURY, also honoured in the same cause, is 23 years old. At the outbreak of war he left Trinity College, Cambridge, where he was studying for the law, and joined the crew of the "Zarifa" as an A.B., the "Zarifa" being a converted yacht manned mostly by Cambridge men. After nearly a year at sea he entered the R.N.A.S., gained his pilot's certificate, and has been stationed on the East Coast for nearly eighteen months. Lieutenant Cadbury is the youngest son of Mr. George Cadbury, chairman of Messrs. Cadbury Bros., Ltd., of Bournville, Birmingham. Mr. George Cadbury, it will be remembered, acquired the *Daily News*, but some years ago disposed of his shares and retired from the board of directors. Two of his sons, brothers of Lieutenant Egbert Cadbury, are, however, actively engaged in the management of both the *Daily News* and the *Star*.

Flight Sub-Lieutenant FANE, who also receives an award, joined the R.N.A.S. on July 22nd of last year. He is 19 years of age, and entered the service straight from Charterhouse. He has done a great deal of flying, and his ability and capacity soon stamped him as a daring pilot.

Captain G. L. WATSON, R.F.C., who was the observer with Lieutenant Roberts when the latter's machine, having had its controls shot away, made a spiral nose dive from 8,000 feet, is now in a London hospital recovering from a fractured ankle and a scalp wound, a German bullet having grazed his temple.

The will of Major HERBERT PHILLIPS FLETCHER, F.R.I.B.A., F.S.I., A.M.I.C.E., attached R.F.C., of New Bridge Street, E.C., and Park House, Marden, Kent, who died on August 3rd, aged 44, from an accident on duty, son of the late Professor Banister Fletcher, at one time M.P. for North-West Wilts, has been proved at £17,077.

AVIATION IN PARLIAMENT.

Orders for Naval Aeroplanes.

MR. JOYNSON-HICKS, in the House of Commons on November 29th, asked the First Lord of the Admiralty—(1) what are the patent rights and other matters which he has learnt are included in the 16 per cent. commission paid by certain American companies to an English barrister for influencing or securing the Admiralty orders for their aeroplanes; and (2) whether any members of his staff acted in any manner as introducer or intermediary between the English barrister acting as agent for an American aeroplane company; and whether he will inquire fully into the ultimate distribution of the sums involved?

Dr. Macnamara: The answer to the first part of Question 7 is in the negative. As regards the other matters referred to in the questions, I do not think I can profitably deal with them until the Admiralty have full information before them as a result of the inquiries now being carried out in the United States. I have already given my hon. friend an assurance that the inquiry already initiated will be full and searching, and I hope he will be prepared to leave the matter at that for the time being.

Mr. Ashley: Will the inquiry include a specific investigation into the prices paid?

Dr. Macnamara: Yes; I said last week that we would go fully into the whole contract.

The Royal Naval Air Service.

MR. JOYNSON-HICKS also asked the First Lord of the Admiralty what proportion of the 95·1 per cent. of the Royal Naval Air Service who are not pilots are serving at home; and what percentage of the officers and men so serving at home are of military age?

Dr. Macnamara: 75 per cent. of the Royal Naval Air Service personnel—excluding pilots—are serving at home. My hon. friend will, of course, be aware that there are many duties which render this necessary. The handling of airships demands a considerable proportion of men per pilot. Then there are mechanics and men engaged on transport and administration work, officers and men engaged on instructional work, and those also employed in connection with experimental gunnery and flying work; and, finally, there is, as my hon. friend knows, a proportion of the personnel employed on coast and sea patrol work. The exact percentage of the officers and men so serving who are of military age cannot be ascertained without a large amount of clerical labour, but it has been estimated for me that about 90 per cent. come within this category.

Mr. Joynson-Hicks: Could not many of the men engaged in clerical work, and some of the control men, be replaced by older men, so that the men of military age might be released for active service?

Dr. Macnamara: In regard to the clerical staff, it has been recently examined, and as to the other part of the question, I will put the point before the responsible authorities.

Mr. Joynson-Hicks asked the First Lord of the Admiralty whether No. 3 Wing of the Royal Naval Air Service, numerically the largest wing of the Royal Naval Air Service, was sent by the Admiralty to its present position on the Continent, where it has been quartered since July, without application for either their presence or their services by Sir Douglas Haig or the general commanding the Royal Flying Corps; and whether either of these officers has the right to call on such wing for help if needed? If the right hon. gentleman feels that to answer this question would not be in the national interest, I do not want it answered.

An Hon. Member: You ought to have thought of that before you put it down.

Mr. Balfour: The force in question was sent in answer to a request from the French military authorities, with whom it is at present serving, and who are, I believe, much satisfied with its performance. It does not operate in the vicinity of the British line, nor is it under the British General Headquarters. But, of course, it forms part of the general forces of the Crown which can be used by the Government wherever they are most needed.

The Bombing of Zeebrugge.

MR. BILLING asked the First Lord of the Admiralty the date when the first Naval Air Squadron was sent to Dunkirk; the date that the order was issued forbidding them to drop bombs on Zeebrugge and district; the reason why such an order was given; whether the Admiralty received application or applications from commanding officers in Dunkirk and district for permission to bombard Zeebrugge and district; the date that such permission was eventually granted; and whether the recent raids have been successful?

Dr. Macnamara: My right hon. friend regrets that questions of this character, dealing with operations, should have been placed upon the Order Paper. The operations referred to are under the control of the Vice-Admiral Commanding, in whose discretion the Admiralty has complete confidence. If the question is intended to convey the impression that either the Vice-Admiral or the Admiralty is not equally determined with my hon. friend to harry the enemy whenever we can do so with profit, I can only assure him that he is much mistaken.

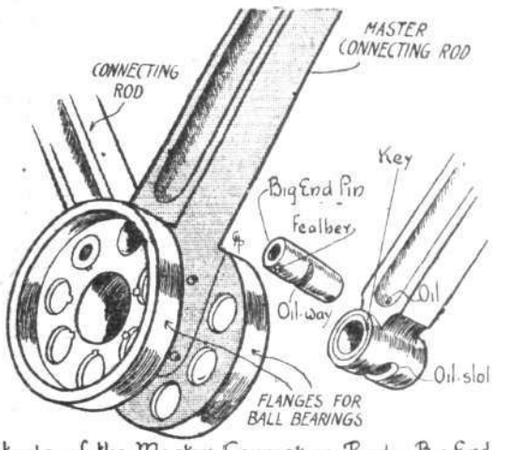
Mr. Billing: Has it come to the right hon. gentleman's notice that the bombing raids on Zeebrugge were stopped for a considerable period, and that they were not renewed until there was a great agitation in the Press and a certain Sea Lord wrote to Admiral Bacon and told him he had better do so?

Dr. Macnamara: I regret to say that is the substance of the question, on which, on behalf of my right hon. friend, I say that it was not desirable to place it upon the Paper. If my hon. friend has any views on the matter, all he has to do is to come and submit them to me.

ANSWERS TO CORRESPONDENTS.

K. H. F. (Birmingham).

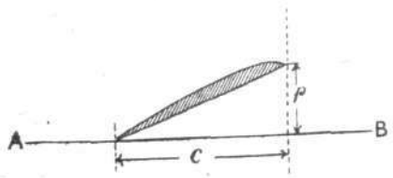
No, the Anzani is not a rotary engine, although its cylinders are disposed in the same fashion as those of rotary engines. It belongs to the type known as radial engines, in which the cylinders are held stationary, while the shaft revolves. The object of providing slots in the sides of the machine you mention is probably to admit a certain amount of air to the engine housing, or else to allow the air passing through the radiator to escape. The louvres, or slots, will probably be found to have lips turned forward or backward according to whether their purpose is the former or latter. Practice differs somewhat in regard to the attachment of connecting rods to crank shaft of rotary engines. We illustrate one method, that employed in the Gnome engines. One of the connecting rods, which is generally termed the master connecting rod, has turned on its big end two flanges into which ball races fit. These flanges are provided with holes for the big end pins of the other connecting rods, the number of holes depending, of course, on the number of cylinders of the engine. The big end pins are feathered to prevent them from turning in the master rod, the bearing being formed between the pins and the big ends of the ordinary connecting rods. We trust our sketch will illustrate the attachment sufficiently clearly.



Details of the Master Connecting Rod & Big End.

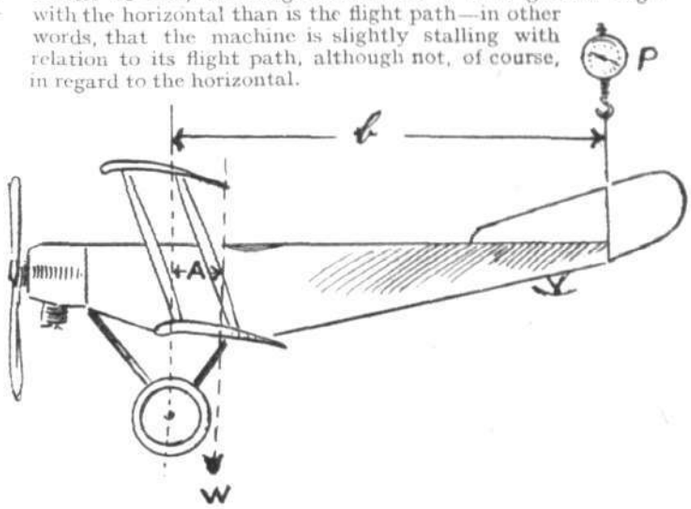
L. J. P. (R.N.A.S.).

The pitch of an airscrew can be found in the following manner: Place the airscrew on a plane surface, such as a table top, with the driving face downward. The distance C,



or the projected width of the blade, is a part of the circumference at the point measured, and the height p of the leading edge of the section above the base line is part of the pitch. The pitch is then found by the formula $P = \frac{2\pi r p}{C}$, where P = pitch, in inches, r = the distance from the axis of the boss to the point measured, in inches, and C = the projected blade width, in inches, π, of course, = 3·1416.

By angle of incidence is meant the angle which the chord of the wing section makes with the relative wind. If a machine is flying horizontal, that is to say neither rising nor falling, with its longitudinal axis horizontal, and the wing chords make an angle of 3 degrees with the longitudinal axis, then, of course, the incidence is 3 degrees. If, however, the machine is tilted with its longitudinal axis at an angle of 10 degrees to the horizontal, it does not necessarily follow that the angle which the chord makes with the relative wind is still 3 degrees. Thus, if the machine is tilted for climbing as mentioned above, but its engine throttled down until the machine can only manage to stagger along on a horizontal flight path in spite of the tilt, then obviously the incidence is 10 + 3 = 13 degrees. In a steep climb it is doubtful if the majority of machines really fly with their longitudinal axis parallel to the flight path. It is much more likely that, as a matter of fact, the longitudinal axis is at a greater angle with the horizontal than is the flight path—in other words, that the machine is slightly stalling with relation to its flight path, although not, of course, in regard to the horizontal.



If it is desired to find the centre of gravity of a machine, and no sufficiently strong scales are at hand which would support the weight of the whole machine, the centre of gravity can be found by the aid of much weaker scales, if the weight of the machine is known. Suppose, for instance, that the weight of a machine is 1,500 lbs., fully loaded, and that its tail is lifted off the ground by a wire attached to a spring scales, while the wheels are resting on the ground. If the distance of the point of attachment of the scale rope from the wheel centres is 15 ft., and the pull on the scales is 100 lbs., then the distance A from the wheel centres to the centre of gravity is $= \frac{100 \times 15}{1500} = 1$ ft. To generalise, the formula is $A = \frac{Pb}{W}$. The slip ratio of a propeller is frequently expressed as $\frac{(p \times r) - V}{p \times r}$, where p = pitch of propeller, in ft., r = revolutions per second, and V = the axial advance of the propeller, that is to say, the speed of the machine, in ft. per second.

P. B. (Desborough).

We believe you can still enlist in the R.N.A.S. for the duration of the war. Apply to the R.N.A.S. Recruiting Station, Brook Green, Hammersmith, W. You could hardly do better than study "Burl's Aero Engines," which can be obtained for 8s. 10d. post free from "FLIGHT" offices. Any time spent in working in a motor garage would give you experience which should prove helpful.

R. A. B. (Rock Ferry).

1. As arranged. 2. You should apply to Adastral House for the particulars. 3. The pay of officers in the R.F.C. is set out on p. 984 of "FLIGHT" for November 9th.

DYNAMICAL STABILITY OF AEROPLANES.*

By JEROME C. HUNSAKER.

Nature of Thesis.

THE writer's thesis under the title here given, of which the following is an abstract, is the result of some three years' work in applied aerodynamics while detailed by the Secretary of the Navy to the Massachusetts Institute of Technology. The preliminary work of erecting the wind tunnel and aerodynamical balance, design and calibration of instruments for velocity measurement, establishment of standard methods of expermentation and, finally, the investigation of the force of the wind upon aeroplane wings, rudders, bodies, and other parts has been fully described elsewhere.† Study of aeroplane parts led naturally to the study of the aerodynamical properties of complete model aeroplanes which forms the substance of this thesis, the objects of which were :—

1. To determine the aerodynamical constants for two aeroplanes by means of model tests in the wind tunnel. One aeroplane was a standard military tractor with no claims to inherent stability in flight, the other machine designed to possess some degree of inherent stability while departing as little as possible from standard practice as exemplified by the other.

2. To apply the aerodynamical constants so found in the dynamical equations of motion for the full scale aeroplanes in free flight, and to examine the stability of the motion by the method of small oscillations, as first applied to the aeroplane by Bryan ‡ and later extended by Bairstow.§

3. To compare the stability both laterally and longitudinally of the two aeroplane types chosen, with a view to tracing to the individual parts of each machine their effects upon the motion.

4. To attempt to formulate general qualitative conclusions which may assist aeroplane constructors to avoid instability or to provide a degree of stability.

5. To throw light upon the general problem of inherent dynamical stability.

Previous Work.

The first rational theory of the dynamical stability of aeroplanes is due to Bryan, whose work was extended and applied by Bairstow with wind tunnel tests. The late E. T. Busk, of the Physical Staff of the Royal Aircraft Factory, England, applied Bairstow's model tests to an actual aeroplane, and recently succeeded in perfecting an inherently stable aeroplane which could be flown "hands off." Neither the details of Busk's experiments nor of the type of aeroplane developed by him have been disclosed by the British War Office, for obvious reasons.

Theoretical aspects of the problem have been discussed by Lanchester, Riessner, Crocco, Bothezat, and others, but the only applications are those of Bairstow and Busk.

Laboratary Work.

Wind tunnel testing of the models under investigation was carried on from June to September, 1915, by the writer and various students under his direction. The mathematical portions of the work were completed during the period October, 1915–March, 1916, with frequent consultation with Professor E. B. Wilson of the Department of Mathematics.

General Problem of Stability.

The stable aeroplane model we designate by S and the unstable aeroplane by U. Both were tested in the same manner. The models were $\frac{1}{8}\frac{1}{4}$ scale, giving a span of about 18 ins. The wind tunnel has a section of 16 sq. ft., and from previous tests it was concluded that the influence of the walls was negligible for models of this size.

The application of model experiments to predict the aerodynamical properties of a full-size aeroplane is well understood, and the validity of such application has been repeatedly demonstrated. We assume that aerodynamical forces vary as the density of the air, as the square of a linear dimension of the model, and as the square of the relative velocity. This is strictly true for inertia and eddy-making resistance, but not quite true for skin friction, which varies less rapidly than the "square law," and must depend somewhat on the viscosity of the air. However, for engineering purposes, it is usual and probably sufficiently exact to assume the "square law" for all resistances.

The investigation is most conveniently discussed in two parts, the first dealing with the longitudinal motion involving pitching of the aeroplane and rising and sinking of its centre of gravity combined with change of forward speed, and the second, with the lateral motion, which involves side-slipping, or skidding, combined with rolling and yawing to right and left.

Stability is distinguished as statical or dynamical. An aeroplane in free flight in still air must be driven at such a speed and kept at such an inclination of wings to wind that the weight is just sustained. The maintenance of this normal attitude is the technique of the aviator. When in its normal attitude the aeroplane, if properly balanced, is in equilibrum. In a statical sense, this equilibrium is stable if righting moments are called into play tending to return the aeroplane to its normal attitude if by any cause it is deviated therefrom. In general an aeroplane, if stable in a statical sense, will, when given an initial deviation, take up an oscillation which either may be damped out or may increase in amplitude. The aeroplane is dynamically stable if, and only if, these oscillations die out as time goes on, leaving the aeroplane in its original normal attitude. It is clear that statical stability must first be provided before the dynamical stability of a design can be examined. Also, without statical stability, there can be no dynamical stability inherent in the aeroplane.

Longitudinal Tests.

The aeroplane model was mounted in the wind tunnel, and the position, magnitude and direction of the resultant wind force determined for a series of altitudes in pitch corresponding to the highest and lowest flight velocities of the full scale aeroplane. This resultant force was then resolved into a couple acting at the centre of gravity and two component forces acting vertically and horizontally. From a consideration of the variation of vertical force or lift with change of angle, the corresponding speeds necessary to sustain the weight were estimated. Likewise, the equilibrium of the aeroplane was adjusted to be statically stable by change in horizontal tail surfaces. After three trials a tail setting was found which gave a proper balance.

With this disposition of surfaces, the rate of change of the component forces and of the couple was computed for use in the equations of motion. The radius of gyration of the aeroplane was estimated from the plans and the damping coefficient obtained by oscillating the model in pitch.

For the better measurement, the model was mounted on a rocker arm made to oscillate by powerful spiral springs. The decrement of amplitude for various wind speeds was a measure of the damping of the pitching motion due to the air. Correction made for the damping due to pivot friction and to the wind on the bare apparatus, the logarithmic decrement was found to vary very nearly as the first power of the velocity as must be expected.

Longitudinal Motion.

The equations of motion for the full scale aeroplane were then written down and the aerodynamical coefficients substituted. Confining the discussion to small oscillations about the equilibrium position, the longitudinal motion is represented by three simultaneous linear differential equations with constant coefficients of a well-known type.

Solution by means of approximate factors shows that the motion may be considered as composed of two oscillations; one of a period of the order of two seconds damped to half amplitude in 0·1 second, the other of period from 10 to 30 seconds not very strongly damped.

From a consideration of the coefficients, the short oscillation appears never to be of importance on ordinary aeroplanes, but the long oscillation, being only moderately damped, may cause trouble, especially for an aeroplane that flies with a large angle of incidence for the wings.

The calculation of the period and damping of the long oscillation was repeated for several speeds from highest to lowest corresponding to small and large angles of incidence with the results shown in the following table :—

* Abstract of a thesis submitted to the Faculty of the Massachusetts Institute of Technology in partial fulfilment of the requirements for the Degree of Doctor of Engineering.

† "Reports on Wind Tunnel Experiments in Aerodynamics," "Smithsonian Institution," Publication 2,368, Washington, January 15th, 1916; "Stable Biplanes," *Engineering*, London, January 7th, and 14th, 1916.

‡ G. H. Bryan, "Stability in Aviation."

§ "Technical Report of the Advisory Committee for Aeronautics," London. 1912–13.

Aeroplane... ...	S.	S.	S.	S.	U.	U.	U.	U.
Velocity ... miles-hour	76·9	53·4	44·6	36·9	79	51·8	47	44·2
Incidence of wings ...	0°	3°	6°	12°	1°	7°	10°	14°
Period secs.	34·7	17·6	15·8	10·56	34·0	16·7	13·7	11·5
Damp 50 per cent. secs.	8·1	11·0	13·1	—	11·0	17·7	63·0	—
Double amplitude secs.	—	—	—	24·7	—	—	—	24·7

Instability at Low Speed.

It appears that the period becomes much more rapid at low speed, that at some critical speed the damping vanishes, and below this speed both aeroplanes become frankly unstable. This instability at extreme low speed is common to all aeroplanes, and the only advantage of our "stable" aeroplane S is that its longitudinal motion is stable down to about 40 miles per hour, while aerolpane U is stable only down to about 47 miles per hour.

The necessary existence of a critical velocity for any aeroplane where the longitudinal stability is believed to be shown here for the first time.

A study of the relative magnitudes of the coefficients for these typical aeroplanes leads to the conclusion that longitudinal instability at low speed is due, first to the decrease in damping of the tail surfaces on account of the low speed, and, secondly, to the decrease in rate of change of lifting force with change in attitude for high angles of incidence. Ordinarily, if an aeroplane heads up, the increased angle of incidence of the wings causes increased lift and the aeroplane rises, and *vice versa*.

However, for an angle of about 15°, all known aeroplane wings reach a maximum lift, and any further increase in incidence causes no increase in lift. This is a critical attitude for the wings. If an aeroplane flies very slowly it must be held at some large angle near this critical angle. If the machine is headed up, giving a greater angle of incidence, it will obtain from the air no greater lift and will not rise. It is "stalled." Indeed, some wings show a marked drop in lift for angles beyond the critical angle.

The coefficient that represents the rate of change of lift with angle of incidence is the predominating term in the expression which represents the damping of the long oscillation, and this coefficient vanishes near the critical angle. Consequently, if an aeroplane is to be stable and land at a relatively slow speed, it must not operate at too great an angle of incidence. To sustain its weight it should therefore have a greater wing area than another aeroplan which lands with about the critical angle for the wings.

The principal difference between aeroplanes S and U is that the former supports a weight of 3·55 pounds per square foot of wing area and the latter 5·2 pounds pe square foot.

The following ecommendations are made for an aeroplane to have its lon itudinal motion damped at lower speeds than is usual in practice :—

1. Provide large horizontal surfaces of long arm for damping the pitching.

2. Provide wings of such area that the slow speed does not require a great angle of incidence. Roughly, the safe slow speed should not require more than 80 per cent. of the maximum lift of the wings.

3. Keep the longitudinal radius of gyration small by concentrating the principal weights.

Slowness in Pitching.

It may be imagined that a dynamically stable aeroplane of rapid period might be so violent in its motion that the pilot would be shaken about to such an extent as to be hindered in the performance of his military duties of observation, gunfire, or bomb dropping. It appears that the expression representing the period of the long oscillation contains certain predominating coefficients, and a consideration of their magnitude leads to the following conclusions :—

The natural period of pitching is increased by :

1. High speed of flight.
2. Large damping surfaces on the tail.
3. Small angle of incidence.
4. Small righting moments.

The righting moments which tend to restore the aeroplane to its normal attitude when it pitches are a measure of statical stability. If the statical stability is great the period of the oscillation will be short and the motion violent. Our desire is an aeroplane that has a gentle motion of slow period heavily damped. Dynamical stability is better given by heavy damping than by excessive stiffness or statical stability.

An ocean liner of too great stiffness (large metacentric height) is not suitable for passenger or cattle carrying service ; it is preferable in ship design to give only enough metacentric height to insure that the vessel is never unstable, and to damp the roll by generous bilge keels.

In a similar manner in aeroplane design, the theory indicates that it is preferable to give just enough statical stability to insure that the aeroplane is never unstable and to make the oscillation dynamically stable by the use of generous damping surface and large wings.

These remarks on damping *versus* stiffness apply with equal force to the lateral motion of the aeroplane, which is the subject of the second part of the thesis.

Lateral Motion.

In a given longitudinal attitude proper for some fixed speed the aeroplane model was tested in the wind tunnel when turned to right and left away from the symmetrical position. For these oblique positions we measured the moment tending to turn the model back into the wind ("yawing" moment), the moment tending to tilt it over laterally ("banking" or rolling moment), and the transverse force tending to push the model to one side. From a series of such measurements the rate of change of yawing moment, rolling moment and lateral force with angle of yaw were estimated.

In the asymmetrical or lateral motion of the aeroplane in flight the angular velocity in roll or yaw is considerably damped by surfaces moving through the air. Consequently it was necessary to obtain damping coefficients for rolling and yawing from model tests on the oscillating beam in a manner similar to that employed to measure the damping of pitching.

When an aeroplane yaws rapidly the more rapidly moving wing lifts more than the other and a rolling moment is produced. Also when an aeroplane rolls, the downward moving wing has a greater angle of incidence than the other, and, therefore, has more resistance to forward motion, producing a yawing moment A method for calculating the rolling moment due to yawing and the yawing moment due to rolling has been devised.

The necessary aerodynamical coefficients being now at hand, and the radii of gyration in roll and yaw, the equations of motion for the asymmetrical motion may be set down. For small oscillations, these reduce to three linear differential equations with constant coefficients. The detriment formed from the coefficients may be factored by use of approximate methods, and the motion compounded from that represented by each of three factors.

(*To be concluded.*)

Air Raids on Bucharest.

WRITING from the Roumanian capital on November 22nd, the *Times* correspondent says :—

"In the message from the Pope received by Queen Marie after the recent air raids, His Holiness congratulated the Queen on her escape from the attacks by the German airmen. This significant message on the part of the head of the Roman Catholic Church to the Sovereign of another communion constitutes an open and public rebuke to the authors' policy of 'frightfulness,' such as it has never yet received, exposing them to the reprobation of the whole civilized world and the condemnation of history.

"To-day's attack lasted for two hours, a great number of bombs being thrown. French and British aircraft were engaged in the defence and several aerial duels took place."

Writing on the following day he says that Rymnik Sarat, in Eastern Roumania, is the latest place to be bombed.

Bombs on Refugees.

REPORTS received in Petrograd from Kieff on November 30th, stated that enemy aeroplanes are mercilessly harrying refugees on all the roads from Bucharest and towns of Western Roumania, dropping bombs on them and firing att hem with machine guns.

AIRCRAFT WORK AT THE FRONT.

OFFICIAL INFORMATION.

British. *General Headquarters, November 28th, 10.30 p.m.*

"In aerial combats one hostile aeroplane was destroyed, and one driven down damaged. Two of our machines are missing."

Admiralty, November 29th.

"During the course of yesterday afternoon (28th inst.) an attack was carried out by naval aeroplanes upon the harbour at Zeebrugge, but owing to weather results could not be observed. All machines returned safely."

Admiralty, November 30th.

"The following operations have been carried out by squadrons of naval aeroplanes operating against the Bulgarian coast between November 23rd and November 28th :—

"Nov. 23rd.—A bomb attack was carried out on Karjani.

"Nov. 24th.—The railway station at Angista and stores in the vicinity were bombed, a direct hit being obtained on the station itself. On the same day an enemy camp near Razolivos was bombed, and the enemy swept with machine-gun fire.

"Nov. 25th.—An attack was carried out on the enemy aerodrome at Drama, and considerable damage was done.

"Nov. 26th.—Further bomb attacks were carried out in the Drama area and at Angista.

"Nov. 27th.—Porna and Doksambos were attacked.

"Nov. 28th.—Drama aerodrome and railway station were again attacked, with very satisfactory results. All our machines returned safely."

Admiralty, December 2nd.

"On Nov. 29th a squadron of British naval aeroplanes operating against the Bulgarian coast, attacked the enemy seaplane base at Gereviz, effecting great damage.

"On Nov. 30th a bomb attack was carried out on Doksambos, and on the same day a troop train near Porna was attacked by two aeroplanes. The men in charge of the engine were wounded and fell out, the train itself proceeding at a high speed with no one in charge."

War Office, December 3rd.

"*Salonica.*—The enemy's camp near Seres was bombed by our aeroplanes and serious damage inflicted."

French. *Paris, November 30th.*

"It is confirmed that on Nov. 23rd at one o'clock in the afternoon Sub-Lieutenant Nungesser brought down his eighteenth aeroplane. The enemy machine was dashed to pieces on the ground near Falvy (Somme region).

"*Salonica.*—Our aircraft dropped many bombs on Prilep."

Paris, December 1st.

"The factories of Thionville and some bivouacs in the region of Damvillers were bombarded last evening by our aircraft.

"*Salonica.*—Prilep has been bombed by our aircraft."

Paris, December 2nd.

"Last night one of our aeroplanes dropped nine bombs of 120 millimetres on the railway station of Spincourt and three of the same calibre on enemy contonments and Billy-sur-Largrennes."

Paris, December 3rd.

"Between 5.50 p.m. and 10 p.m. on the night of Dec. 2nd–3rd, seven aeroplanes dropped 720 kilogrammes of projectiles on the factories of Thionville and on the enemy's aviation hangars and cantonments at Etain."

Italian. *Rome, November 30th.*

"Hostile aircraft attempted to raid several localities in the theatre of operations, but no damage or casualties are reported. Numerous air fights took place, which ended in the enemy aeroplanes being driven off, and two were shot down in the Agno Valley and near Castel Nuovo, in the Sugana Valley."

Rome, December 1st.

"Hostile aircraft made raids on several points in the theatre of operations, but were driven off by the anti-aircraft guns and fighters. Enemy aeroplanes dropped bombs on Grigno, in the Sugana valley, without doing any damage. One of our air squadrons dropped numerous bombs on the station of Volano, north of Rovereto, causing damage and fires. Another squadron dropped bombs on the station of Rifemberga (Reifenberg), in the Branizza valley. Some trains standing were hit. All our aeroplanes returned in safety."

Rome, December 2nd.

"Enemy aircraft dropped bombs on Vicenza without causing casualties, but doing some damage to the Church of St. Corona."

Rome, December 3rd.

"Our aeroplanes bombed enemy billets and Dorimberg (Dornberg) and Tabor, in the Frigido (Vippacco) Valley. All our machines returned safely."

Rome, December 4th.

"One of our air squadrons yesterday bombed the railway station for Dottogliano and Scoppo (Skopo), on the Carso [7½ miles north-east of Trieste]. Notwithstanding bad weather conditions and the violent fire of the enemy artillery, our aviators came down low to drop a ton and a half of high explosive on the targets. Numerous air fights took place, and one enemy machine was brought down; one of ours is still missing.

"Hostile seaplanes dropped bombs at several points on the Carso, without causing casualties or damage. As a reprisal an aeroplane dropped five large bombs on the floating hangars at Trieste, with excellent results."

Serbian. *Salonica, November 29th.*

"Our aviators bombarded objects of military importance at Prilep."

Bulgarian. *Sofia, November 29th.*

"An enemy aeroplane dropped two bombs on the village of Radolivo."

Sofia, December 2nd.

"Two enemy seaplanes, flying from the Island of Thasos towards Porte Lagos, were received by our artillery and machine-gun fire. At the same time two German seaplanes bore down upon them. One of the enemy seaplanes was brought down on land and the other into the sea. We made prisoners the four aviators, one of whom was wounded."

BRITISH AIR WORK.

THE following typical incidents extracted from the *communiqués* of the Royal Flying Corps in France from October 14th to October 28th, have been issued by the Air Board :—

"Oct. 15th, Co-operation with Artillery.—Artillery fire was directed by our aeroplanes on to many hostile batteries. A building believed to be an ammunition depôt was hit and a heavy explosion resulted. Direct hits were also obtained on two anti-aircraft batteries. In another sector of our front our artillery fire, directed by aeroplanes, destroyed 70 yards of railway, damaged two gun pits, and blew up six ammunition pits. Second Lieutenant H. attacked and dispersed from a height of 800 feet a company of infantry.

"Oct. 16th, Fights with Hostile Aircraft.—Second Lieutenant B. and Air-Mechanic B. engaged three machines, one of which crashed to earth. Four French machines joined in the fight, which resulted in the destruction of a second German machine.

"Oct. 17th, Bombing.—Two railway stations were simultaneously attacked by our machines. In one case a moving train was hit, and in both cases damage was observed to the station buildings and rolling stock. Nineteen 12-lb. bombs were also dropped on a siding and ammunition dump.

"Oct. 20th.—This was a day of great aerial activity, and well illustrates the extent and variety of the services performed by our airmen in the field.

"Reconnaissance.—Six of our machines, while taking photographs, were heavily attacked by anti-aircraft, guns, and soon after by 12 hostile fighting machines. One of our machines was brought down by the enemy in his lines and another brought to land behind our lines, with the pilot severely wounded. The enemy machines having withdrawn, Captain D., the leader of our formation, tried to complete his reconnaissance accompanied by only two escorting machines. He was again attacked, and another of our machines retired with engine and propeller damaged. Captain D. then

fought his way homeward, surrounded by hostile machines, and landed safely.

"Artillery Co-operation.—In spite of somewhat serious enemy opposition in the air, this was maintained along our whole front, and fire was directed on to 141 targets.

"Bombing.—Nineteen incendiary and 66 20-lb. bombs were dropped on hutments. A railway station and sidings were raided, the permanent way damaged and four trucks derailed. Some ammunition sheds were also attacked.

"Photography.—More than 700 photographs were taken.

"Fights with Hostile Aircraft.—The number of combats in the air exceeded 80. Seven enemy machines were seen to crash or to fall out of control, and there can be no doubt that others of these which were driven down by our airmen were wrecked in landing. The fact that these combats took place over the enemy's lines prevents absolute verification.

"Casualties.—It is not to be expected that operations on this scale can be carried out without losses of valuable lives or without wastage in material. Three of our airmen were killed, three reported missing, and five wounded.

"Oct. 21st.—Second Lieutenant T. and Second Lieutenant A., on offensive patrol, brought down two machines. One was seen to fall in a wood, and its destruction was confirmed. The second machine fell in flames.

"Second Lieutenant S., though mortally wounded by gun fire, brought his machine and observer safely back to his aerodrome. He died of his wounds next day.

"Oct. 22nd, Artillery Co-operation.—A captured letter written by a man of a German artillery regiment affords a good clue to the damage caused by our artillery. It states that during eight weeks his battery fired 34,000 rounds and used up 28 guns, of which 17 were knocked out by British artillery fire.

"Hostile Aircraft.—Captain H. and Captain S. (Observer) engaged five enemy machines and destroyed one.

"Bombing.—Thirty-five 112-lb. bombs were dropped in and round a railway station with good results. At another station a moving train was hit, and other bombs were dropped on the buildings and rolling stock.

"Two of our machines, piloted by Second Lieutenant G. and Lieutenant S., while on patrol, encountered six enemy machines. Lieutenant S., though wounded in the head at the beginning of the fight, continued to fight for a considerable time, and drove down one of the enemy machines out of control."

The following extracts from *communiqués* received from the Royal Flying Corps in France, was issued by the Air Board on December 4th:—

"Oct. 28th.—Two of our machines were attacked by six enemy machines, who were almost immediately joined by six more. At the end of five minutes' strenuous fighting two of the German machines collided. The fight continued for about 15 minutes, when all the enemy machines withdrew and ours returned undamaged. It seems probable that this is the fight in which Captain Boelcke was killed, as he was reported in the German wireless news to have been killed as the result of a collision in the air on that date.

"Nov. 9th.—A bright clear day resulted in unusual activity on the part of the enemy's aircraft. His aeroplanes actively co-operated with his artillery. On several occasions our artillery and photographic machines were molested, and our bombing expeditions, reconnaissance and patrols were constantly engaged throughout the day while over the enemy's country.

"Night Bombing.—On the night of Nov. 9th–10th, three enemy aerodromes, two railway stations, and several trains were bombed at night by our machines. Several drums of ammunition were also fired from a low altitude into some enemy trenches."

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The London Raider.

ACCORDING to the *Pall Mall Gazette*, the pilot of the German machine which dropped bombs on London last week was Master-Pilot Carl Meyer, the crack German aviator on the Belgian coast.

Commanders of the Lost Zepps.

GERMAN papers give the names of the commanders of the two Zeppelins lost in the last raid on England as Capt. Max Diederich and Senior Lieut. Frankenberg, both of whom are described in the German press as specially capable and meritorious officers. It is stated that Diederich was a captain in the service of the North-German Lloyd, and that at the beginning of the war he succeeded in getting the steamship *Brandenburg* out of Baltimore and bringing her safely by way of the north of Scotland to Trondhjem.

An 8,000 Feet Fall.

WRITING home to his parents, 2nd Lieut. E. P. Roberts, Sussex Regiment and R.F.C., tells of a miraculous escape he had recently:—

"Am out of it again for the winter. We were fighting seven Huns. My friend brought one down. I fell, out of control, for 8,000 ft. I remember falling, but don't remember hitting the ground. My machine was wrecked in a shell hole just inside our lines. At first my left leg was thought to be broken; but now I think it is only my knee which is dislocated. Apart from being a bit tender inside I am all right. My observer is rather bad with a scalp wound, concussion, and an injured back."

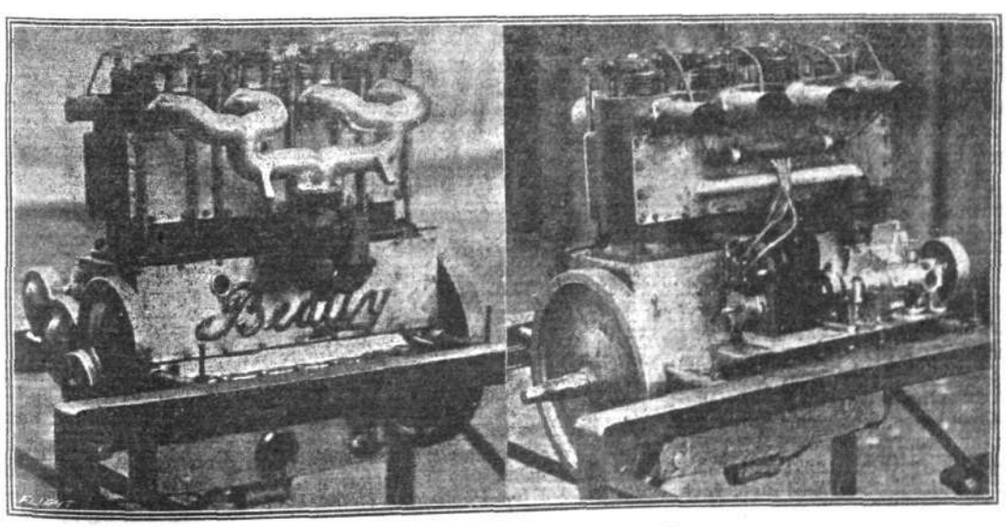
◈ ◈

A Zeppelin Victim.

AT an inquest at a North-East town on December 1st, on the body of a provision dealer's manager, aged about 40, who was fatally wounded by a Zeppelin bomb on the previous Monday, a verdict was returned that he was "killed by a bomb from a Zeppelin that was the same night destroyed."

A Fatal Accident.

WHILE starting off for a flight in the North of England, on the afternoon of November 27th, Lieut. Hall met with a fatal accident. Apparently, the engine stopped and the machine nose-dived to the ground, the pilot being instantly killed.



The Beatty engine in its latest form. The cylinders are now cast *monobloc* with aluminium side plates to the water jackets. *Aluminium alloy* pistons are another development. The original engine was fully described in "FLIGHT" for May 11th.

SIDE-WINDS.

WITH his wide and long experience in connection with the aviation industry, Mr. Max Worms should make a very flourishing business of his latest enterprise, the Worms Aircraft Construction Co. He has taken works at Twickenham, and while he will be open to contract for any aeroplane work, he will specialise in complete aeroplane wings. He will continue his West End offices at 4, Sackville Street, W. In this new development Mr. Max Worms has our best wishes, and we shall watch the growth of the firm with considerable interest.

IT is good news to hear that Mrs. Latimer Voigt, so well known in connection with the Integral Propeller Co., who has been very seriously ill, is now making good progress towards recovery. She has unfortunately had to undergo a serious operation for appendicitis, but it is gratifying to hear that it was completely successful, and her many friends will join in wishing her a speedy and complete restoration to health and vigour.

THE employees of Messrs. Vickers, Ltd., at their Crayford branch suffered a grievous loss on Saturday in the destruction by fire of the Princess Theatre, which, it may be recalled, was opened by Princess Christian on July 26th. During the time it has been open it has been greatly appreciated by the Vickers village, and it will be very much missed during the winter months.

ART publications of the highest character are not expected in such times as these, even with Christmas and the New Year to justify their production. Therefore the arrival this week of the 1917 "Abdulla" almanac has come as a pleasant surprise. Last year this production was quite unique amongst new issues, but the enterprise of the firm in preparing their Annual was more than justified by the result. And so again we prophesy for the 1917 edition a "sold out" ticket within a very few weeks from date. The fact that Messrs. Abdullah and Co. present 20,000 copies of their remarkable calendar for sale at 1s. each for the benefit of the British Red Cross Society, is more than justification for the work and expense put into its production. As in the past year, the firm's own advertisement on the almanac is of such an artistic design in itself, and so subdued withal, that the most particular could hardly object. In the scheme of 12 pictures —one for each month—a happy idea has been very successfully carried out. Each picture, whether in colours or tone, is by a different artist, representing England and her Colonies or one of the Allied countries, Frank Dadd, R.I., and E. A. Cox, R.B.A., being responsible for the Mother Country, Paul Thiriat for France, Michael Sevier for Russia and Alcide D. Campestrini standing for Italian art. Our thanks to Messrs. Abdulla and Co. for sending us their almanac with their compliments.

FROM THE BRITISH FLYING GROUNDS.

Bournemouth School.

ROLLING alone last week: Mr. Fisher. Straights alone: Messrs. Peat, Vermorel and Ross. Circuits and eights: Messrs. Allen, Hall and Vivian.

Instructors: Messrs. E. Brynildsen and H. Smith.

Certificate taken during the week by Mr. Vivian. Mr. Hall did A and B tests for "ticket."

NEW COMPANIES REGISTERED.

PEGASUS AIRCRAFT CO., LTD.—Capital: £1,000, in £1 shares. Engineers, manufacturers of aeroplanes, airships and motor cars, propellers, engines, &c.

SPLINTERLESS ANTI-MIST GLASS SYND., LTD.—Capital: £1,000 in £1 shares. Manufacturers of compound, safety, uncloudable, anti-mist and multi-glass goggles and anti-gas appliances of all kinds, &c.

TIBBENHAM'S AVIATION CO., LTD., Dunster House, 12, Mark Lane, E.C.—Capital: £1,000 in £1 shares. Objects: To promote the science or sport of flying and aerial locomotion, to manufacture and deal in aeroplanes, &c. The company shall not engage in furniture or decoration work or in the manufacture of aeroplane propellers without the sanction of Frederick Tibbenham, Ltd. First directors: H. Stoner, J. G. Taylor, E. H. Cowen, F. Tibbenham and S. Cole.

UNAFFILIATED MODEL CLUBS DIARY AND REPORTS.

Club reports of chief work done are published monthly. Secretaries' reports, to be included, must reach the Editor on the last Monday in each month.

Finsbury Park & District (66, SOUTH VIEW RD., HORNSEY).

Monthly Report.—Owing to the inclement weather experienced during the last two months, the amount of flying has been rather less than usual. A gale was blowing on Oct. 7th, but, nevertheless, two juniors, viz., R. E. Stansell and C. E. Plummer, ventured out, and made a few flights with small tractor monoplanes. Similar weather prevailed on the 14th, but Messrs. F. E. Rayner, A. Richards and E. Coleman were out with hollow-spar tractor monos., making several good flights. Mr. Rayner's model eventually smashed up. The same two juniors were out as on the previous Saturday. On the 21st all the above members were out, with the addition of Mr. H. Mullin. All the models flew well. The 28th was practically a blank day, owing to the high wind blowing. A new junior, P. J. Poultney, was at work with small mono., but unfortunately it smashed up. Had the weather been fine, Nov. 4th would have been an eventful day, as a competition had been arranged for the £1 so generously presented to the club by Mr. A. E. Jones, head of the well-known model accessory firm in New Oxford Street, London. Several machines were out, but no great durations were made. The secretary's brother (in khaki), Drummer H. M. Rayner, was flying a small Morane tractor, which developed a good speed. Wind still prevailed on the 11th, but there were seven models flying. Undoubtedly, the best flights of the afternoon were made by the hollow-spar tractor monos. belonging to Messrs. Coleman and Rayner. They were making flights of 500 yards at about 100 feet altitude, with a duration of nearly 50 secs. Other hollow-spar models were being flown by Messrs. Richards, Burchell, Hardinge, Stansell and Plummer with considerable success. The 18th was wet and windy. On the 25th Mr. Rayner was testing a large 4-foot model intended for the aforementioned competition, and found that the elevator was not large enough. Messrs. Coleman, Richards and Plummer were flying models, which behaved very well and made several lengthy flights. A club meeting was held at the house of Mr. Hardinge on Oct. 26th, when several important discussions took place. Sincere regret was felt when Mr. H. Mullin tendered his resignation from the position of treasurer; he has filled this office from the foundation of the club in the summer of 1913. Mr. A. Richards was elected to fill the vacancy, and his duties begin at the commencement of the new year. On Nov. 11th a communication was received from a junior signing himself as A. Doré, but no address was given, hence the inability of the secretary to reply.

PUBLICATION RECEIVED.

The "Abdulla" Almanac, 1917. London: Abdulla and Co., Ltd., 168, New Bond Street, London, W. Price, 1s. Proceeds for the benefit of the British Red Cross Society.

Aeronautical Patents Published.

Applied for in 1915.

Published December 7th, 1916.

5,707. K. C. MOTTE. Bodies of aeroplanes, seaplanes, boats, &c.
15,747. O. SCHILE. Means for maintaining lateral balance of flying machines.
16,197. E. R. CALTHROP. Parachutes.

Applied for in 1916.

The numbers in brackets are those under which the specifications are printed and abridged, &c.

Published November 30th, 1916.

7,980. D. MACKAY. Aerostructures. (102,021.)
10,969. G. T. RICHARDS. Construction of aeroplane flying machines. (102,032.)

Published December 7th, 1916.

2,610. S. SADLER. Control handle for aeroplanes. (102,083.)

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